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JOURNAL OF FORESTRY

Vol. XXXIII — JANUARY, 1935 — No. 1

Beginning with this, the first number of Volume XXXIII, the Journal *embarks on its new schedule of 12 monthly issues of 96 pages each—a total gain per volume of 128 pages over the past schedule of 8 issues per year. This enlarged service has been made possible by the improved financial condition of the Society brought about by the loyalty and support of its steadily increasing membership.*

The editorial policy will continue unchanged. It can perhaps best be expressed by quoting from our first editor-in-chief, in his letter of resignation (Jour. For. *Vol. XXVI, pp. 410-412*).

"In them (the volumes of previous years) are also bound some literary traditions. Of these, at least two I hope may be preserved forever: Unflinching adherence to the principles of free expression and free criticism. No creed, however extreme, no theory, however radical, should be barred from the pages of the Journal *just because of the ideas expounded. Free criticism of the most established and sacred tenets of our profession should be maintained. And no editor, whether he is a school man or a Forest Service man, should ever use the* Journal *for his personal glorification or the glorification of the institution to which he belongs, but always maintain it as an independent, common forum for the entire Society."*

EDITORIAL

Public Cooperation Under Article X

AT the Conference in January, 1934, at which time the program of action under Article X of the Lumber ;ode was jointly adopted by representaives of the lumber industry and of public gencies, Section 7 of the Report of the ;ommittee on Forest Practices was incororated, which reads, "The measure of success ultimately achieved by these underakings of the industry is dependent upon he extent and character of public coöpertion in each state." At the same time, ;ommittee IV, on Coöperative Public Exenditures, adopted a report which incororated the measures and the approximate ums suggested for carrying out such a proram. A joint committee of ten was appointed by the Conference whose duty it was to make every effort to carry out the proposed program. A sub-committee on legislation then formulated the draft of a Bill to be submitted to Congress.

This Bill was never even introduced during the last session. After much delay its contents were briefly presented to the President, but did not receive the approval of the Executive. A few of the appropriations contemplated were later secured in part through the regular appropriation bills and by the allocation of emergency funds.

The good faith of the lumber industry has been demonstrated in the organization of divisional forestry committees under

the Code and in appointment by them of able and experienced foresters employed by the several regional Code divisions, whose duty it is to educate and organize the units of the industry in the carrying out of the minimum silvicultural requirements formulated by each of the Divisions. The industry, however, has expressed its opinion that the public program of coöperation has lagged far behind its own efforts in carrying out the purposes of the Conference, and it is not beyond the bounds of possibility that this sentiment might be used as an alibi by individuals in neglecting to comply with the provisions of Article X.

In seeking an explanation of this situation, two facts appear to be of outstanding importance; first, that certain measures were introduced as part of the program of public coöperation which though sponsored alike by the industry and the public representatives, may justly be claimed as not germane to the purpose of Article X, which is to secure the practice of forestry on private lands; second, that the error both in the Conference and later in Committee was to ask for the maximum amount necessary to carry out not merely those measures which directly affected private coöperation but also those objectives incorporated in the program which did not directly bear upon the purpose of the undertaking but which were a part of the larger and wider plan for public forest policy as a whole as expressed in the Copeland Report. That this was not good strategy should be sufficiently clear both to the industry and the public agencies by the failure to receive Executive consideration for the Bill in the form submitted. Yet apparently, this mistake is to be repeated in the present Congress. It is our opinion that if progress is to be made in redeeming the responsibility for public coöperation set up by the Conference, the measures introduced as a part of this coöperative program should be confined strictly to those features which have to do with the encouragement of private forest practices, and that the program of public acquisition should stand on its own feet.

In order to permit private owners to practice forestry, they must be assured of more efficient protection against fire, insects and diseases. Definite progress must be made in reaching some adequate solution of the taxation problem. The proposal for forest credits should be pushed to its conclusion. Owners of woodlots should be brought within the scope of Article X by providing adequate extension services and otherwise. Such a four-point program involves merely a rational development of activities and does not saddle the coöperative features of Article X with an unbearable load of appropriations for purposes extraneous to this public objective, notwithstanding the real merits of these other measures.

Although the industry may claim to have proceeded faster than the public, yet it is well known that the administration of the Code in certain regions has been abnormally delayed through the failure to secure inclusion of wood industries other than lumber within its provisions. The responsibility for removing this difficulty, must rest with the National Recovery Administration.

The forest practice rules formulated under Article X represent reasonable minimum requirements. Actually there are in every forest region operators who have progressed in forest management considerably beyond these requirements previous to the adoption and without the stimulus of the Code. The initial objective of the Code is to bring recalcitrant operators into line and to educate those not informed of the possibilities of forest practice.

This is by no means its ultimate purpose. The President has said that it would take twenty years to realize the full possibilities of forest practice under the Code. It is the definite purpose of Article X to lift the

ıdustry from a temporary, destructive asis to one of sustained yield and perma-ent, stable economic establishment, work-ıg within the possibilities of private own-rship and on the theory that such owner-ıip and management should be given very encouragement and be perpetuated s an indispensable element in forest land ıanagement.

As to the status of public coöperation, ıe lumber industry will not dispute the ıct that already and for some time past, ıe responsibility for fire protection has een increasingly recognized and met by deral and state agencies, through effi-ent organization and large expenditures, ough as yet the ultimate goal of ade-ıate financial aid has not been attained. huge program of white pine blister rust ntrol has been carried on by C.C.C. and ıergency funds. The U. S. Forest Taxa-on Inquiry has completed an extensive udy, which will appear in print shortly, now advising Oregon as to a state tax ogram and its services are available for nilar assignments.

The study of forest credits is reaching e form of proposed legislation, and with enactment, the "measure of success" ac-ally achieved by public agencies *in those öperative features which are indis-nsable to private forestry practice will well abreast of the steps taken by the lustry.* In actual fact, in spite of the lure to secure legislative adoption of the rogram" of the conference in toto, *both public and private features of this great tional undertaking are proceeding on an en keel.*

There is a real danger in the misplaced ort of the conference to use this coöp-ıtive clause No. 7 for a general or blank-"appropriation" bill for the furtherance a huge public acquisition program. On part of discouraged individuals with-the industry, this reflects a desire and tendency diametrically opposed to perma-nent forest ownership, namely, the wish to unload on the public and get out. On the part of the government, there is a distinct and rapid development of a policy of ac-quiring tracts which represent the cream of private forest holdings, those with the maximum chance of practicing forestry on the basis of a tax-yielding private industry, and this policy is defended by the argu-ment that it is good business for the gov-ernment to acquire the best private lands rather than those incapable of yielding in-come for a long period of time. Private industry, beset and bedeviled by high taxes and local political chicanery of a type exemplified in one or two southern states, may easily fall for a cash purchase price and turn its responsibilities and pros-pects over to Uncle Sam. With the best lands thus acquired by the public, of what will the proposed residue of land to be left to private ownership consist, and what success could be looked for in its private management? An honest and clean-cut pro-gram to carry out the fundamental purpose of Article X, the conservation clause of the lumber code, should be freed once and for all from such questionable alliances, and rest solely on the measures which will advance, and not defeat, the cause of pri-vate forest ownership and practice. In the furtherance of this aim, public agencies should seek the advice of impartial scien-tific and economic organizations and indi-viduals, state forestry departments, and other interests affected by the broad poli-cies of land use involved, and above all should avoid the tendency to formulate and proceed with legislative programs without giving full consideration to such views.

The Society of American Foresters, in this and other matters of both public and scientific import, will, without regard for prejudice, class interests or economic shib-

boleths, seek to ascertain the facts upon which the success or failure of such measures rests, and to present in the JOURNAL such evidence as will aid the profession and the public to reach wise and constructive decisions that will stand the test of time and experience. We believe that private forestry, under Article X, is a vital element in preserving a healthful economic balance in society and we hope that all the interests concerned, both public and private, will go forward in a united effort to clear away the remaining obstacles and establish it on firm foundations.

H. H. CHAPMAN,
President.
FRANKLIN REED,
Editor-in-Chief.

For a profession which, like forestry, has to deal with the direct application of knowledge to practical problems, the need of an opportunity to see such application in actuality and to have a hand in the practice early, is obvious; just as in the engineering or medical profession or in fact almost any other profession. Yet we must not forget that all practice is based on theory; and the more thorough the theoretical knowledge, the more intelligent and more sure will be the practice.

The attempt to satisfy the popular but ignorant cry for so-called "practical instruction" usually leads to the production of superficial and incompetent practitioners lacking a safe guide in thorough knowledge, although by no means lacking in self-assurance. I would, therefore, advise any student of forestry in this country, as well as in any other, to lay as broad a foundation of theoretical knowledge as he can afford; he will be more successful in the end with his practice.—B. E. FERNOW, in *The Forester* (1889).

AMERICAN TIMBERLAND OWNERS STUDY GERMAN PRIVATE FOREST PRACTICE

Under the auspices of the Oberlaender Trust of the Carl Schurz Memorial Foundation, a group of lumbermen and forestry advisors visited a number of typical private forest estates in Germany and Czechoslovakia during August, 1934.

The party consisted of W. R. Brown, Brown Co., Berlin, N. H.; P. R. Camp, Vice President, Camp Mfg. Co., Franklin, Va., Member of Conservation Committee, Southern Pine Association; Wilson Compton, Secretary-Manager, National Lumber Manufacturers' Association, Washington, D. C.; George F. Cornwall, Editor, *The Timberman*, Portland, Ore.; J. J. Farrell, President, Farrell Lumber Co., Poland, N. Y., Chairman, Conservation Committee, Northeastern Lumber Mfrs. Association; R. B. Goodman, Sawyer-Goodman Co., Marinette, Wis., President, Northern Hemlock & Hardwood Mfrs. Association, Director, National Lumber Mfrs. Association; C. H. Guise, Professor of Forestry, Cornell University, Ithaca, N. Y.; L. K. Pomeroy, President, Ozark-Badger Lumber Co., Wilmar, Ark.; John Raine, President, Meadow River Lumber Co., Rainelle, W. Va., Chairman, Committee on Forest Conservation, Hardwood Mfrs. Institute; Lee Robinson, President, Mobile River Sawmill Co., Mt. Vernon, Ala., President, Hardwood Mfrs. Institute, Director, National Lumber Mfrs. Association, Alternate, Lumber Code Authority; T. S. Walker, Manager, Red River Lumber Co., Westwood, Calif., Executive Committee (Forest Conservation) Western Pine Association; and John Watzek, Jr., Director at Large of National Lumber Mfrs. Association, President, Crossett-Watzek-Gates, Chicago, Ill., Alternate, Lumber Code Authority. The party was conducted by Dr. Franz Heske and his assistant, Dr. Reinhard Trendelenburg. Mr. Ward Shepard joined the party on the final days of the tour.

The party visited the estates of and was entertained by Baron von Keudell and Baron von Kalitsch (Prussia); Count Schaffgotsch (Silesia); Tharandt Forest School, Count Holnstein, Baron Vietinghoff, Count von Arnim and Dr. Diener von Schonberg (Saxony); Prince Hohenlohe-Langenburg, Count Czernin and Prince Schwartzenberg (Czechoslovakia).

Quoting Dr. Heske, "The forests of Central Europe that have been under a sustained management for so long a time are like a gigantic experimental forest for world forest management."

The Foundation could have rendered no more timely service than in affording a group of American forest owners and lumber manufacturers an opportunity to see for themselves what sustained yield forest management has come to mean in Central Europe. The NRA Code for the lumber and forest products industries contemplates continuous forest production and encourages sustained yield forest practice.

The Foundation has a permanent Forest Advisory Committee consisting of Henry S. Graves, Earle H. Clapp and Cedric H. Guise.

We are pleased to present a symposium briefly summarizing the impressions and conclusions formed by some of these Americans who saw the German forests.—R. B. Goodman.

THE PURPOSE OF THE EUROPEAN FORESTRY TOUR

By WARD SHEPARD

N 1932-33 I had the privilege of spending a year, under the auspices of the Oberlaender Trust of the Carl Schurz emorial Foundation, in the German-eaking countries of Central Europe—rmany, Czechoslovakia and Austria. The rpose of this assignment was to make general study of public forest policy th on public and on private lands, and so to make an exploratory study of those aspects of Central European forestry which would be most helpful to America, in case the Foundation should develop a policy of sending American foresters abroad. In upwards of a year spent in these countries, during the course of which I travelled some fifteen thousand miles by motor, inspected practically all types of forest land, public and private, large and small, consulted with innumerable forest

managers, specialists, educators, and public officials, I was deeply impressed with the great accomplishment of these countries in the fields of public and private forestry, and with the vitality and progressiveness of the whole forest movement there. Perhaps most of all I was impressed with what might be called the philosophy of the forestry movement—composed first of all of a universal feeling of responsibility, on the part of land-owners, foresters, and the public at large, for the preservation of natural resources, and of the accepted truism that any social or economic system that tolerates their destruction is fundamentally false.

It was, therefore, in the hope of spreading knowledge of this underlying philosophy of forestry, as well as of the practical manner in which it has been put into effect on the great forest estates of Central Europe, that the Oberlaender Trust and the Carl Schurz Memorial Foundation decided to send a representative group of American timberland owners to Central Europe. Before setting forth the special purposes of this forestry excursion, it will be well to describe briefly the work and ideals of the Oberlaender Trust and the Carl Schurz Memorial Foundation.

The Foundation was established through the generosity of Mr. Ferdinand Thun and a group of associates, in order to foster cultural understanding and sympathy between the German-speaking and the American peoples; and more specifically, through an exchange of workers, to bring to America a better knowledge of those elements of German culture which might be helpful or suggestive to this country. In carrying out this broad purpose, the Foundation has sent a considerable number of Americans to the German-speaking countries, and has brought a limited number of Germans to this country to lecture, write, and travel. The Oberlaender Trust is an integral part of the Foundation. Its specific purpose is to be of service to the American people through men and women who are in a position to make an immediate contribution to public life.

The Foundation has no special field of work which it desires to cultivate through the exchange of workers. It carefully avoids anything in the nature of politics or propaganda. It seeks to select mature workers, occupying positions of responsibility and influence, in order that the results of any given line of study may have an opportunity to bear practical fruit. It puts the emphasis on practical rather than theoretical study or abstruse research. It has, for example, supported studies in municipal government, sanitation, journalism, labor conditions, forestry, etc. It has promoted an interchange in the fine arts, as when it sent a famous American orchestral leader to give concerts of American music in numerous German cities, and brought to this country a famous German scholar who spoke in dozens of cities on the life and work of Goethe.

In spite of the broad and cosmopolitan interests of the Foundation, it is pleasant to record that the Director, Dr. Wilbur K. Thomas, and the Board of Trustees have a particularly warm feeling toward forestry. Several of the founders are American citizens of German birth, who in their youth had a first-hand knowledge and love of the beautiful German forests. They recognized, moreover, that the principles of sustained yield forest management have been carried perhaps to their highest form in the German-speaking countries. This great social enterprise, worked out to an amazing perfection over the course of more than a century through the collaboration of generations of foresters imbued with a great ideal, is a cultural contribution of the first magnitude to world civilization. Sustained yield forest management is, indeed, the pioneer and type of long-range economic and social planning far outstripping, in its qualities of imag

nation and provision, and in length of ime evolved, all the five-year and other lans that have so intrigued the world for he past several years. It was therefore vith a very keen sympathetic interest and nthusiasm that the Foundation approved he plan for the timberland owners' forstry excursion.

In planning this excursion, it was beieved that first-hand knowledge of the rinciples, technique, and the ideals of ustained yield management, particularly n the large private estates of Central Euope, would be helpful and suggestive to merican timberland owners, not only on heir own lands, but in working toward the pplication of sustained yield managenent under Article X of the Lumber Code. The old managed forests of Cenral Europe are the end product of a long rocess of planning and of care, on which ve have just made a beginning in America. So few are the managed forests in America which actually exhibit the technique and esults of sustained management that timerland owners, and even many foresters, have to fall back on theoretical expositions of the idea rather than concrete examples. It was therefore believed that a group of alert and influential timberand owners, observing on the ground living examples of sustained yield management in full flower, studying not merey its profits as a business, but its fareaching social, economic, and esthetic efects, and coming directly in touch with he highly developed sense of social reponsibility on the part of land owners, ould not fail to exert a decidedly helpful influence on the development of forestry, public and private, in America.

I had myself been profoundly impressed with the admirable management of the orests of Germany, Austria and Czechoslovakia. In the course of very extensive ravels I had not seen a single devastated cre, except for occasional ravages of the un moth. Everywhere were beautiful forests tended as carefully as gardens. Most surprising of all was the highly developed management of the large private forests, many of them properties that had been in possession of the same noble families for centuries. I visited one great forest that had been owned by the same family since about the year 1200, and where one of the Oberförster (Chief Foresters) came from a family of foresters who, from father to son, had been in the service of the same family for 450 years.

Everywhere in these great private forests one found not merely intensive, permanent management of a high order, but also a special and impressive sense of social responsibility on the part of the owner—responsibility to his family, down through unborn generations, and responsibility to the people at large for the guardianship of precious natural resources.

And then, backing up and supporting this feeling of the owner's responsibility, is the almost universal love of the German people for their beautiful forests. The German has two great passions—music and the forest. Public opinion in Germany would not tolerate forest devastation, even if the owner should attempt to practice it—a thing in itself unthinkable.

It may be alleged that the fine management of these great estate forests is an offshoot of the peculiar code of honor—*noblesse oblige*—inherent in the disappearing remnant of feudalism. This is partly true, but only partly. The Central European nobleman has a long tradition of public service and social responsibility, but he is also, by and large, a skillful and productive manager of land. These great land-owning families derive most of their revenues from the land and many of them chiefly from forests.

It has often been said in America that there is no such thing as profitable private forestry in Europe. To a European forest owner this would be laughable; and to

a foreign visitor who observed the forest operations on the ground and the grand manner in which these forest magnates live, the statement seems equally laughable. To be sure, the European forest owner does not attempt to reckon a percentage return on a certain capital. How can he determine the capital value of a type of property which is not on the market often enough to establish a sale value? He knows that in normal times he makes a good profit over and above his costs.

Regardless of the question of profitableness of private forestry in Europe, it was recognized that neither the economic nor the silvicultural technique, nor the type of ownership of European forests were directly applicable to American conditions. Rather it was the belief of the Foundation and its advisors that a first-hand view of these forests in all their aspects would be stimulating and suggestive to American forest owners, and would throw great light on some of the baffling aspects of American forestry.

That this result was achieved is, I think, amply shown by the articles contributed to this issue of the Journal by several members of the excursion. Perhaps equally important were the friendly relations established between this group of representative Americans and their European hosts, and the sympathetic insight gained by the travellers into the deeper and more permanent values of German civilization.

It was a piece of good fortune that Dr. Franz Heske was engaged by the Foundation as leader and interpreter of the philosophy and technique of German forestry to this group of American forest owners. Dr. Heske, who is not only a distinguished academic authority on forestry, but an expert forest manager of wide experience in large-scale private sustained yield management, spent three months last spring investigating the forest problems of the United States under the auspices of the Carl Schurz Foundation. His brilliant and dynamic leadership of the tour was a large element in its success.

The influence of this group, individually and collectively, on the development of new forestry ideals in America, promises to be substantial. To this end, the Foundation hopes to maintain the identity of the group and to encourage it to make the most of the knowledge and experience its members gained from the tour. Further, to continue its work in the field of forestry, the Foundation is now making plans, in coöperation with various forestry agencies, to send foresters—perhaps several each year—to observe and study individual aspects of German forestry.

It is not expected by the Foundation that the techniques of German forestry can be bodily transplanted to America. Technical values there are—and plenty of them; but over and above that, direct experience by leading American foresters of the finished achievements of German forestry cannot fail to introduce fresh currents of faith and a more hopeful philosophy into the American forestry movement. Many of the inhibitions and pessimisms so long current here have been the by-products of a false social philosophy and a now discredited economic system. The creative success of generations of European foresters and the social responsibility inherent in European land ownership are helpful guides in the great creative task confronting American foresters and timberland owners.

It is interesting to recall that Carl Schurz was the real "father of forestry" in America. For it was he who first proposed the creation of the national forest system. The field of forestry seems therefore an unusually appropriate activity for the Foundation, and one which, on other grounds, it is disposed to develop.

GERMAN FORESTRY A TEACHER TO AMERICA

By WILSON COMPTON

GENEROUS acknowledgment should be accorded to Dr. Franz Heske, the Director of the historic forestry :hool at Tharandt, for the care with which ur itinerary was mapped out and the per- ect management of our tour of the German ıd Czechoslovakian forests, which was ıade by motor coach. We feel under reat obligation also to the innumerable overnment officials, forest owners, and ther persons who contributed to the suc- ess of a trip which, notwithstanding the ritical period in German history, was not ıarred by a single untoward incident. We ere received with infinite courtesy.

General Forest Data

The forest area of Germany is given as 2,000,000 acres, approximately one-twen- eth of the forest land area of the United tates. But Germany is fourth among the ountries in Europe in respect of forest rea. Russia is first in total forest area, ith the forest land proportion of the coun- y 33 per cent. Finland is second in re- pect of proportion with 61 per cent, and weden third with 52 per cent of her lands ı forest; Austria comes next with 37 per ent, then Germany with 27 per cent.

We were told that 46 per cent of Ger- ıany's area is classified as farm land, 11 er cent as meadows, 5 per cent as grazing ınd and 11 per cent as waste lands, cities, ivers and roads. The forest area of Ger- ıany works out to half an acre per capita f population, which may be compared ith approximately five acres in the United tates. As to ownership, the State has 33 er cent of the German forest area, local ommunities 16 per cent, public funds 2 er cent, corporations 3 per cent, and indi- iduals 48 per cent. Of the last, one-quar- er is entailed; and each generation of wnership must maintain its inheritance, being permitted to use only the growth during its lifetime. Thirty-four per cent of the private forests is individually owned without the limitation of entail; 48 per cent is in holdings of more than 250 acres each, and 27 per cent in tracts of less than 250 acres. Of the state forests, less than 2 per cent are not under sustained yield management and the same proportion prevails in the large private forests.

Management for sustained yield has been consistently maintained for as much as 150 years on some of these private and public forests; and some of the private forests have had thrifty utilization for as much as 500 years.

We were informed that as a generalization it was fair to say that the state-owned forests yield 510 feet board measure of timber per acre annually; the communal forests 440; large private holdings 460 to 500 feet; unmanaged woodlots 240 feet.

An interesting social fact is that on the average the small holdings of 250 acres support 11 persons. Tracts from 500 to 1,250 acres carry 19 persons; 1,250 to 2,500 acre tracts 41; 2,500 to 5,000, 91; 12,500, 152; and forests averaging above 12,500 acres support 260 people.

The annual timber production of Germany is 12.5 billion board feet, divided about equally between pulpwood and minor uses on the one hand, and lumber on the other. The annual consumption of lumber in Germany is about 10 billion board feet and imports run around 3.75 billion feet. The total wood *requirements* of the country are put at 30,000,000 cubic meters of lumber and the same amount of fuel, pulpwood, poles and the like. Imports were formerly 15,000,000 cubic centimeters annually; last year they were restricted to 3

or 4 billion. Seventy-one per cent of German forests are softwood, principally pine, spruce, fir and larch; and the chief hardwoods are beech and oak.

Some Fundamental Differences

I have spoken of 500 years of thrifty forest use; I might have made it 800, for in the forest of Krumhübel in the Riesengebirge, owned by Count Schaffgotsch, we found 800 years of ownership in the same family. Also, this ancient holding is the largest private forest in Germany, having an area of 75,000 acres, of which 62,000 acres are in forest, 57 per cent being productive. The rest is devoted to grazing or is mountain top of no particular use. In this magnificent "tame" forest we were privileged to see the results of regulation of yield extending back to 1770.

I particularly mention this great period of time because I think we are inclined to compare forest management in America and in Europe without considering that they are on different time scales, and in profoundly different social and economic settings. With the exception of a few estates to which the conservation principle was applied for reasons of family and personal power, or pride, or desire to have superior game cover, reproductive management of the forests of Europe began, on the whole, not much more than 100 years ago. And it proceeded from causes similar to those which are now beginning in the United States. The virgin forests were about destroyed, and the neglected volunteer second growth was not satisfactory in quality or sufficient in quantity. There was a greater demand for timber than could longer be supplied locally and regionally. Timber growing came in, not as a program of neat national housekeeping, but because of economic necessity.

Owing to the rapidity with which the American continent was occupied by European civilization in the industrial age, it took us only about 100 years to reach regionally, if not nationally, the economic position, with reference to the forests, which it took Europe 2,000 years to attain. People don't manage anything until management pays; and nothing would have been more ridiculous, when you come to think about it, than to have started "managing" forests at a stage when the real social problem was how to get rid of them. Incidentally, that is about the only cause of quarrel I have ever had with my friends, the foresters of the United States; I mean the somewhat sacrosanct attitude of superiority of the intellectual forester to the unfortunate dumb business man who happens to be pursuing in the forests the great American game of getting on in the world. The present differences between the American forest position and that of Europe must, I believe, always be kept in mind, both in making comparisons, invidious or otherwise, and in endeavoring to profit by European experience and practice.

That diversion recalls to mind the revered Forstliche Hochschule at Tharandt. Of course, Dr. Heske was bubbling over with justified pride as he showed us his own school—a school that might be described as the common Alma Mater of the forest schools of the world. As all foresters know, this school was established in 1816 by Heinrich von Cotta, and up to 1930 had graduated 5,000 students, 3,547 being German and 1,479 foreign. This oldest forest school does not have a large forest—only 4,000 acres—but it has, of course, an exceptional appeal to the interest of all who are concerned with forests. There is here a solid beech forest which is 300 years old, but for the most part the school land forests were destroyed during the wars of the French Revolution.

Economy May Be Waste

It grew on us more and more during our trip that the success of German forestry as

lemonstrated in private management is argely due to unique conditions. These lo not yet prevail in the United States. Perhaps they never will, except regionally. For example, at present we have no comparable market for either original or derived by-products of the forests, such as uel, forest litter and minor wood uses. Nor do we have log and lumber markets within an ox-cart haul of the woods. Even so, the Germans are giving much thought o new uses. One of these which seems to have a good deal of promise is the development of wood-producer gas as a substitute for gasoline. At present Germany produces only a third of the gasoline it consumes, including gasoline derived from ignite and coal. About 1,000 trucks are now using wood gas, which is produced on he truck as it runs, and the cost is about one-half the cost of gasoline. A broad consideration in respect of utilization here, as compared with Europe, is the tendency of wood consumption to decline. The menace of substitutes is greater here than in Europe, and Europeans have the advantage of relatively small forest capacity. Where forests cover great areas, as in the United States, the total supply of wood, which even now is potentially increasing, does not offer encouragement for expensive, intensive forest management. It may not be encouraging, but at the same time it may be a fact that protective measures may be he most that can be expected from American woods management, inasmuch as intensive management can easily produce, over a period of years, far more wood than we may reasonably expect to find a market for in the visible future. As in agriculture, the American way in forestry is likely to be toward maximum productivity of labor instead of land. In Germany the land-use problem is rather one of the extension of agriculture, while here it is one of curtailment of agriculture. Thus, while our forest growing area is automatically increasing, the tendency under nationalistic policies in Germany is to reduce them; actually, forest "exploitation" has revived in Germany. At present German forestry has the advantage of higher prices for its logs and other forest products than prevail in the United States, and at the same time the costs of production are lower. But, alas, even in wood-prizing Germany, men spoke to me sadly and apprehensively of the growth of substitution and the decline of wood consumption.

Sawmill wages in Germany, as we learned about them, averaged between 80 and 100 reichsmarks per month, which is obviously much below most American wages. From the standpoint of the worker this is compensated for by the fact that under the German system of forest land utilization the worker is usually steadily employed—sometimes as a logger, sometimes as a farm hand, and sometimes as a worker in sawmills or other industries.

The German forests, being largely owned by old families and each generation holding them largely in trust for posterity, are regarded simply as a source of income which may be satisfactory or unsatisfactory in gross, but are not thought of with reference to any fixed principal sum representing land capitalization. In fact, many of the computed figures of land values given us were fantastic.

Another salient advantage of forestry practice in Europe is that of low and adapted taxation, the common practice being an extremely low annual property tax, associated with a heavier tax on net income and a moderate tax on gross yield.

On one estate we obtained the following analysis of the balance sheet: Management expense, including logging, 35 per cent of the gross income; administrative expense, 33 per cent; more or less fixed burdens such as taxes, compulsory forestry dues, interest on loans, etc., 29 per cent; net profit, 3 per cent.

Forestry as a Business

While it is true, as indicated in the foregoing, that conditions are sharply divergent between the forestry and economic conditions of Europe and of the United States, we nevertheless can learn much from the Germans about forestry as a business. We cannot escape the forest problem in this country. It cannot be solved in the tradition of exploitation. No matter how much the market for forest products may be curtailed in the future, the forests must have some planning care. Obviously they must be administered so as to yield maximum possible returns, no matter how unsatisfactory they may be. (Parenthetically, though, I would say that I believe the time is coming when our forest wealth will again be one of our greatest natural assets.)

Here we have 600 million acres of forest land, of which more than 400 million acres are privately owned. It is both an individual and a national responsibility to make the utmost possible economic utilization of these vast resources. Herein is an inspiring challenge to American forest industries. They must be reborn to be saved. Somewhere between the reckless exploitation of the past in America and the meticulous care that characterizes German forests will be found our true course. American forest owners will come to a conception of their properties as requiring care, even under temporarily adverse conditions. Even in Germany there would be very little individual forest management if there were no dependable income from forest properties. We will not have managed forests which do not pay their way. It is literally true that forests are maintained by use. It is the wise and liberal consumption of forest products which will progressively pave the way for the preservation of the forests.

I do not expect that we shall ever see in America forests comparable to the exquisitely manicured forests of Europe. Our great land resources make this unnecessary. With us the forests will depend largely upon natural regeneration and extensive rather than intensive management. Where private forestry cannot thus be made to pay its way, the recourse in the long run is public ownership and management. Public forest ownership in many areas is inevitable and desirable. But the best route to the progressive national solution of our forest problem lies, I believe, in the avenues laid down in the Forest Conservation Code: minimum silvicultural operating rules, encouragements to sustained yield forest management supplemented and supported by the types of public coöperation contemplated in the recommendations of the federal forestry conferences of 1933 and 1934. If courageously adhered to, these can be made to work. As practical aids in this direction, contact with the valuable experience of the nations of Europe which have struggled with the same problems for over a century is timely, and will, I think, prove in the long run to have been of great value.

CENTRAL EUROPEAN EXPERIENCE IN THE MANAGEMENT OF PRIVATELY OWNED FORESTS

By CEDRIC H. GUISE

To give representative American timberland owners an opportunity to see exactly how privately owned forests of central Europe are managed was the primary objective of the Carl Schurz Memorial Foundation in planning the trip. It was hoped that the men selected would gain both the philosophy and to some extent the technique of sustained yield forest management. All visits were confined to

roperties in private ownership. The de-ails of planning the itinerary and making reliminary arrangements were in the ands of Doctor Franz Heske, Professor of 'orest Management at the *Forstliche Hoch-chule* at Tharandt. Professor Heske se-ected properties of various sizes, ranging n general from 2,000 to 65,000 acres, in oth the pine and spruce regions. One for-st, however, probably the largest private-y owned forest in central Europe, aggre-ated over 200,000 acres.

Regardless of size, the forests of every state visited were highly organized and fficiently administered by forest officers nd their assistants. All operations were ontrolled by working plans which are re-ised every tenth year. Some of the for-sts have been under strict working plan ontrol for over 150 years. The smaller orests are naturally administered under ie provisions of a single plan. The larger oldings are divided into districts, each of hich has its separate plan. The Schwartz-nburg forests, 207,000 acres in area, have ine plans currently in operation, one for ach of the nine districts into which the roperties are divided for management urposes. These working plans are large nd elaborate documents. They are in onstant use, and a study of some of them iowed on almost every page notations in-icating intensive management of every rest compartment. It is significant that e individual as well as the state uses the rest working plan to control the manage-ent of his property, and to provide an fective system of records and accounts.

The general make up of the various plans different owners and the types of infor-ation and prescriptions included are ore or less alike. Maps, stand and stock ventories, increment statistics, rotations, ea sub-divisions, silvicultural manage-ent, and felling budgets are covered and tegrated appropriately. In general the ntinental forest working plan consists al-ost entirely of a bound volume of carefully prepared forms, one for each compartment, on which essential information, prescriptions, and executed management may be entered statistically, or with brief notations.

Elaborate maps accompany each working plan. These maps show all details of topography, area subdivision, cover, stand, age, and plans for cutting during the current ten year working period. Colors and symbols are used skillfully to show types and species, and for any one species, spruce for example, the age is indicated by depth of shading. Areas being cut and reproduced are shown by a system of cross-hatching. The majority of the properties visited, both in Germany and Czechoslovakia, were using the same type of map, and incidentally have been using them for many years. At the Schwartzenburg forests in Bohemia, management plan control was established for all forests in 1852. A visit to the working plans institute, where the activities of forest management are centered, enables one to see, for each district, a complete series of these maps, one for each decade. The school forest at Tharandt has a complete series of similar maps dating from 1821. There is great advantage in having a standard type of forest maps in that one can readily read from them the history of the forests' development.

Rotations for softwoods in general vary from 80 to 120 years, depending upon species and site. At several forests, rotations for spruce on the higher mountain slopes had been established at 140 years. Rotations for hardwoods are usually 150 years. Area subdivision is always carefully worked out for most effective management. The larger forests were subdivided into districts, reviers and compartments. Regardless of size all forests were ultimately subdivided into compartments, the detailed unit of management, based on species and age. Compartments vary in size but are almost always under 100 acres in area. In

every forest visited compartment lines, corners and boundaries were conspicuously marked.

Inasmuch as all of the forests visited were essentially pure even-aged stands of pine or spruce, clear cutting, usually followed by planting, was the predominant system of silviculture employed. However, the tendency at present is to develop stands of a mixed rather than pure character and to transform the even-aged stands to those of a selection type. This policy will, if its adoption becomes widespread, result ultimately in many forests much different in form and composition than those produced under the clear cutting and planting methods used heretofore. The adoption of this policy will also introduce a method of determining the periodic felling budget other than the volume-area method so commonly employed to the present.

The above discussion is perhaps somewhat general, but the points made are typical of the broader phases of forest management encountered on the properties visited. To present more concretely the details of management of privately owned properties, several specific and typical examples are selected. One is a relatively small pine forest belonging to Baron von Keudell; the other a large spruce forest owned by Reichsgraf von Schäffgotsch.

The Baron von Keudell Estate

The estate of General Baron von Keudell, head of the Prussian Forest Service and President of the Deutscher Forstverien, comprises approximately 6,400 acres, of which 4,000 are in forests. It is located northeast of Berlin and characterized by the generally flat topography and poor sandy soils common to that region. Forest management was started over 100 years ago. The original forests, largely oak, were transformed almost entirely to Scotch pine by clear cutting and forest planting methods. Most of the mature forests are consequently of this species, but the owner is now following a silvicultural policy which will increase considerably the proportion of beech and other broadleaf species. All operations are controlled by forest working plans, with one forest officer and two rangers in charge. The volume-area method of determining the felling budget is used. The silviculture is extraordinarily intensive, probably more so than on any property visited. Where clear cutting, the system still used most extensively, is employed, the stumps are later removed and the soil then plowed. The plowed areas are then planted with trees spaced very closely, seldom over two feet apart. Density of the developing crops is reduced by frequent thinnings. Mixtures and underplantings with rather complicated combinations of species are common. Reforested areas are fenced for protection against game. For pine a rotation of 120 years is used, for hardwoods 150 years. There is a great amount of labor involved, obviously, in the handling of these forests, yet the Baron is convinced that, on his estate, such a practice is profitable. Baron von Keudell literally grows his trees as he does his agricultural crops. It was stated by the owner that his estate provides a livelihood for sixty families, which engage primarily in agricultural work, and thirty additional families which find their chief source of livelihood from labor in the forests. The workers on the farms and in the forests aid each other during the seasons when the respective agricultural and forestry activities are at their height. The Baron took special pains to point out the social problems involved, and stated that the continued holding of large areas of farm and forest land resulted in a definite obligation to provide for the numerous families which were an integral part in the management of the properties. Statistics dealing with growing stock, increment and annual cut were not available at the time this article was prepared.

The Schaffgotsch Estate

The forest estates of Reichsgraf von Schäffgotsch in the Riesengebirge of southeastern Silesia comprise 62,000 acres, of which 57,000 acres are in highly productive forests, and 5,000 acres in forests of low productivity, grass, and alpine lands.[1] Forest records extend back to 1593, although yield regulation was not established until 1770. The 57,000 acres, administered by an Oberforstmeister, are divided into five districts, each in charge of a forest officer. In each district there are from nine to eleven rangers and guards. The forest land has been carefully classified into zones, depending primarily upon elevation. The most productive forests lie between elevations of 1,200 and 2,800 feet and are operated upon a rotation of 100 years. Between 2,800 and 3,600 feet less favorable growth conditions prevail, and forests in this zone are managed on a rotation of 140 years. In both zones a clear cutting system, followed by planting, is employed. Natural regeneration is not reliable in this region. Between elevations of 3,600 and 4,100 feet the forests are primarily for watershed protection, and are cut over selectively. The upper zone, over 4,100 feet, is a mixture of alpine and stunted growth, meadows and rocks. The average annual precipitation is between 45 and 55 inches. Ninety-five per cent of the growing stock is composed of Norway spruce, four per cent of Scotch pine, and one per cent of larch, birch, poplar and miscellaneous hardwoods. Figures were given to the effect that there is a growing stock of approximately one billion board feet, an annual cut of twenty-five million board feet, and an average volume per acre at rotation age of between 45,000 and 50,000 board feet. Seventy-five per cent of the annual cut is made up of final fellings and 25 per cent of thinnings. Seventy per cent goes into lumber, 10 per cent into pulpwood, and 20 per cent into fuelwood.

Although cutting plans are carefully worked out in advance, severe wind storms often cause great damage. When bad blowdowns occur, the cutting plans are immediately revised. In fact, the annual cut, which is the equivalent of the annual increment, must generally be adjusted to take care of storm break and blow-down, which sometimes make up 20 per cent of its total volume.

While the two examples cited are treated in a very brief manner, enough has been written to show that privately owned forest properties do exist in central Europe where intensive forest management of the highest type is practiced. These holdings are representative of many others. At the von Schäffgotsch forests it is possible to see the results of sustained yield management practiced for over 160 years; at the von Keudell property, similar results for a period of over 100 years. Not only could one grasp the broader policies and philosophy which underlie the management of these and other forests, but he could see clearly and in detail the manner in which the policies had been and were being carried out. Here was visible an area recently cut over and reforested; there an area of mature timber, and elsewhere the areas of forest representing every intermediate age class. In many places could be seen the areas cut over with the felled trees still on the ground. And in almost every forest were visible the neat piles of one or more cubic meters of wood removed in thinnings to be used for paper pulp or fuel. On all of these properties the forests are more heavily stocked and in better condition than they were a century ago.

In summary, the party was shown nu-

[1]A detailed presentation of the management of the forests of Reichsgraf von Schäffgotsch will be found under the title, "*Die forstlichen Verhältnisse der Herrschaft Schäffgotsch im Riesen-und Isergebirge*" (*Oberforstmeister Köhler-Hermsdorf*) *Jahrbuch des Selesisches Forstverein für 1927.*

merous examples of the practice of sustained yield forestry on privately owned forest properties, both large and small, with all operations controlled strictly by the provisions of working plans, and administered with great efficiency by highly trained foresters. It was shown that it is possible to grow forests of high quality and heavy yield if the proper technical attention is devoted to their management. At the same time it was apparent that economic and political factors are of the greatest importance in making possible sustained yield management. The problem to a large extent resolves itself into a question of basic policy, land forest ownership in relation to capital values, financial obligations, and the political treatment accorded the owner by the state. The forest land owner in central Europe regards his property much in the same light as we regard an inherited long time bond of high quality. What he wants is a reasonable income, from a property which must be maintained in productive condition. He is seldom interested in capital values of his lands and forests. He feels, with the present uncertainty of money values and the restricted investment field, that in timberland he has a property which will be less affected by inflation or unsettled economic conditions than will be almost any other type of estate.

Naturally with the great variation in economic conditions, the wholesale adoption by timberland owners in United States of the system of intensive forest management found abroad cannot be suggested. But we may expect on privately owned holdings in this country, a type of management which is possible and best in relation to our own specific economic and social limitations. Much of the technique of management must be worked out in the light of American conditions, but a knowledge and understanding of what the Europeans did years ago in order to solve similar problems of land use is invaluable. They have solved many of their land problems. Perhaps they can aid us to do likewise.

APPLICATIONS OF GERMAN FORESTRY TO CONDITIONS IN THE SOUTH

By L. K. POMEROY

PRIVATE forestry has been proven to be successful in central European countries and it undoubtedly can be profitably practiced in most parts of the United States. In fact, it has already been demonstrated that selective logging is financially remunerative in the South, particularly in the shortleaf yellow pine belt.

This is due primarily to the fact that shortleaf yellow pine is especially adapted to growth acceleration after selective logging and to reforestation due to the prolific tendencies of the species. It is also favored by the climatic and soil conditions in the South where it grows.

In most parts of the South, timber will grow at a rapid rate and reproduce naturally following cutting operations, without planting expense, if given the proper chance by first leaving seed trees and then keeping fires out of the woods.

The volume of annual growth obtained can be regulated up to certain limits by the amount of growing stock left and by its distribution on the land. The larger the volume and the better the distribution, the greater will be the annual growth. The natural factors entering into successful private forestry most certainly exist in abundance in the South by virtue of desirable species, good soil and excellent climate.

Notwithstanding the favorable factors, however, there remains much to be accom-

lished in the South before intensive private forestry can be made as attractive to private capital as it is today in Germany and other central European countries, where timber investments are ranked exceedingly high. Efficient fire protection must be inaugurated and existing stands must not be cleanly cut. Also, the land use problem is in need of intensive study and development in the South where there has always been the tendency to clear all land, regardless of its suitability for the raising of cotton or other agricultural crops. The disposition of this important problem is vital to a successful forestry program. In the United States as a whole, we are virtually lacking in a land use plan, whereas, in Germany and in the central European countries, an effective program has been planned and developed.

One of the first facts impressed upon us this past summer while studying forestry in Germany was the efficient manner in which the land use problem had been solved. Centuries of experience, intensive study and research have resulted in a perfected land use program. We learned that, first, all lands suitable for agriculture were being used for raising agricultural products; secondly, lands not suitable for agriculture were set aside for meadows, grazing or for forest growing; thirdly, another class of land, not strictly suitable for either farming or forests, was set aside for recreational uses. In the recreational classification, it was frequently found that there was a combination of recreational use and limited forest growing.

Thus our first big lesson from Germany applicable to the South was that lands could and should be segregated for the best uses to which they are adapted and then devoted strictly to intensively producing for the needs of the population. For example, in Germany, 27 per cent of the total area is now in forest, 46 per cent is cultivated for agriculture crops, 11 per cent used for meadows, 5 per cent is devoted to grazing and the remaining 11 per cent is taken up by roads, rivers, recreational parks and miscellaneous uses. Such a program for land use should be similarly solved for the South as quickly as possible if forestry in southern yellow pine is to be given a fair trial and the hoped-for results are to be obtained.

There is one angle to the German thought, however, that must be explained to more clearly show why there are some extreme differences between land use in Germany and in the United States. In America, all properties are regarded as the possession solely of the present owner. In Germany, all properties are regarded as belonging to future generations and are only under the management and protection of the present owner. In America, freedom is interpreted to mean that any man is free to do anything, even to the complete destruction of his property, if he so desires. In Germany, and this is especially true under the new order of things there, freedom is interpreted to mean that a man is free to build up his property and community. He is expected to constructively build for unborn generations.

With this idea in mind, the State assumes the responsibility of offering regulations and protective measures concerning real property for the benefit of the future family. The State emphatically contends that no man shall infringe on the private rights of his children. Throughout German history, it has been this same aim, in one form or another, that has kept the Nation's forests, whether public or private owned, in a constant state of productivity. This has been accomplished under careful forest management. Forest crops have been continuously harvested and enjoyed without depleting the aggregate forest stands.

One slogan all of us became familiar with while in Germany was that "*All wealth springs from the soil.*" This is the creed of all land owners and especially the

forest owners whose families for generations, even centuries, have been given a fine type of livelihood from the products of the forests.

With this slogan and its underlying idea thoroughly instilled in their every economic thought, it is not surprising that every forest owner with whom we came in contact intensively worked and protected his lands. Every available foot of space was being made to produce. No owner seemed generally satisfied with the methods of reproduction as provided by nature alone, but was doing everything within his ability to further its work in keeping his lands well stocked and up to the maximum productivity.

In America, we are prone to be satisfied with a shortsighted policy of taking all as we go, and fail, either through ignorance or negligence, to get the maximum benefits from the timbered properties we own. Once a territory is gleaned of its timber, the land is seldom protected and is frequently utterly abandoned to the vicissitudes of Fate. In this one respect, we can perhaps learn our greatest lesson from Germany and the older countries of Europe. It must be true that all material wealth does spring from the soil. Therefore, it must hold true that the better the protection and the more efficient the use given the soil, the more prosperous will be the individual and the nation.

The American forest owner in particular can learn this lesson of intensive protection and cultivation of forest lands. The experience of European countries demonstrates the many profitable rewards of better timber protection and conservation, better utilization of timber products and more intensive use of lands in growing timber. Their example provides a standard of efficiency which Americans should strive to achieve.

From a practical standpoint, it is probable that planting on a large scale will not be feasible in private American forestry for some time to come, and it is not needed in the South, but there is no doubt that programs for filling in blank spaces in forests, as is done in Europe, would be practical at the present time.

Each forest visited by our party was on sustained yield and was operated under a definite forestry plan. In the matter of having a well worked out forestry plan, nearly all American forest owners could indulge profitably at the present time. In this connection perhaps nothing in the annals of the American industry has been more haphazard than the methods with which timberlands have been handled. It is true that some companies in the United States have already formulated some kind of a forestry plan, some few may have always had a more or less primitive plan, but it is doubtful if anyone has adopted a plan in America whereby his lands could be dedicated to the production of forests perpetually for the benefits of succeeding generations. This lesson of a well planned management can be of immediate use in America.

After viewing the expensive and tortuous path that the German private forest owner must travel to get his new tree crops, we can feel especially blessed in the South with our opportunities to get good results, without the great expense of cultivation and planting. We need merely a judicious selective cutting policy and then protection of the cut through areas from fire. It is a known fact that after selective cutting in southern yellow pine, the trees that are left grow with an accelerated rate and if fire is kept out of the areas, the reproduction in but a year or two amounts to an abundance of new trees, naturally seeded, for each tree cut. Our main objective, therefore, in practicing private forestry in the South, should be to leave a generous and well distributed growing stock, including healthy and thrifty seed trees, and then to keep fires out of the woods by adequate protection.

Should the reproduction fail to distrib-ıte itself satisfactorily in the cut areas, it vould no doubt pay the owner to lend ome assistance in getting the new growth tarted by a limited planting program in he bare spots.

There is no doubt that there is urgent ıeed for better forest practices in America ıt the present time. While it is probably rue that we could not embark immediately on intensive forestry as it is practiced in Germany and other European countries lue to the present economic conditions of he lumber industry, we should neverthe-ess begin at once to become more appre-iative of our forests and endeavor to awaken the public to the importance of orest conservation as a social problem.

To bring a full realization of the value of the forests of America, the timber own-ers and the public alike must be educated n the value of having a definite forestry olan. The plan should provide for ade-quate conservation and protection and then or utilization without depletion of what is conserved as it matures.

An interesting and significant fact that we learned in Germany, especially in view of the greatly depreciated values of tim-ber in the United States of late, was that due to the excellent care and fine upkeep of the forests combined with their com-plete utilization, European bankers rank timber investments among the highest of all forms of investment.

Properties now in timber in the United States should be made to remain in timber until such time as a land use program is perfected. This land use program should designate just what areas should be de-voted perpetually to forest growing.

We would do well to assume the social viewpoint of the German; that is, that for-ests must be protected and conserved for future generations. The present property owners should be made to realize through systematic education that they are, from a social standpoint, in reality not the owners but merely custodians of valuable assets to the nation as a whole as well as to the communities in which they are located. This, of course, does not mean that timber and forests should not be cut, but on the contrary, they should be cut and utilized judiciously.

The South presents every factor needed for successful, sustained yield forest man-agement and it only remains for the pri-vate forest owner and public alike to grasp the significance of perpetual forest indus-tries and the task will be well begun.

IMPRESSIONS AND LESSONS OF THE OBERLAENDER TOUR

By GEORGE F. CORNWALL

HAVING seen and heard something of the German ideal, and tasted of the hospitality of a wonderful people, this far western member of the Oberlaender expedition returns with the conclusion that progress toward the real-ization of sustained yield in the United States will depend to a large extent upon how readily the American lumber indus-try will succumb to the continental for-estry viewpoint which was discovered to run substantially like this:

"Any sound forestry philosophy places duty to society and state before vested right, which means to say that trees are the common heritage of mankind, placed on earth by a bountiful Nature for all to use and enjoy. Being both perishable and re-newable, trees are things to be used intel-ligently when ready to harvest, and things to be replaced for generations to come."

There is no quarrel with the high pur-poses of this doctrine by those on the Pa-cific Coast or by those in any other forest region of the United States, but it seems unlikely that the whole cloth of such a

philosophy will be donned by the lumber industry of our country until radical reforms can be effected in taxation methods. The cold fact is staring us in the face that many lumber operations west of the Rocky Mountains represent merely devices by which owners expect or hope to retrieve timber investments, or remnants thereof, made many years ago. Many of them are so engrossed in immediate economic problems that little imagination or incentive is left them for the consideration of long range forestry programs.

This does not mean that they do not recognize merit in any sound suggestion or plan, which might insure an adequate supply of timber for coming generations. The sympathetic attitude is not lacking, but until pressure is relieved in certain directions, forestry is not going to be added to their cares.

It is our belief that scientific forestry works best where the supply of timber is somewhat less than the demands of the market; if not that exactly, where the supply and the demand are more closely balanced than they are today in the United States. To us it would seem risky to rush into the business of growing timber, if we are to be left at the mercy of competition from the distressed holdings of our neighbors. We are afraid that is what we are up against in this country. Tax reforms might not wholly solve this difficulty either. It might require an ironclad federal law restricting output to annual increment. Then what a yell would ascend to high heaven!

From our observations in Europe, it appears quite evident that timber can be grown equally as well in the United States, even without the exacting care demanded by European forestry standards. The South and the Douglas fir region both, with a far better annual rainfall, can grow trees at a better rate than most of the regions visited on the tour. Nor shall we be compelled by necessity to leave the poorest lands for timber crops, as they have been forced to do in most parts of Europe, where a food supply for the crowded millions has the first claim on the soil.

Except in a few favored cases, the possibility of sustained yield operations, depending upon privately owned land, is visionary as things now stand on the Pacific Coast. Our old-growth fir stands, already hundreds of years old, are questionable laboratories for sustained yield experiments. Much of this timber is now over-ripe or deteriorating and hardly seems suitable for long-time holding.

It would appear that sustained yield operations in this region can best be brought about by tax reforms and stabilization of cut-over lands and timber ownership, combining private with governmental effort. This would entail the blocking of huge areas into long-time working units, and the limiting of the cut to the actual productive capacity of the lands involved. A few such projects would certainly constitute worthy experiments and it is to be hoped that a start may be made in this direction.

To an observer from the Pacific Coast, one of the most valuable lessons learned on the Oberlaender expedition was that big trees are not such an important consideration as we in the West have been accustomed to believe. Excellent lumber is produced from the small timber of the Continent, and in years to come it is conceivable that our demands for clear lumber will be served from the field of plywood. A few big trees will provide the necessary clear faces for a lot of sound, knotted material in the cores. On the other hand, the structural material, aside from larger sizes, is just as good in Europe as it is in America.

To summarize briefly, it is doubtful if European forestry as practiced in Germany can be transplanted in one fell swoop to American soil, and be expected to flourish, until changes come in our viewpoint of ownership, as pointed out

elsewhere by Dr. Wilson Compton. To bring this about, men will have to be satisfied with an annual income from timber without regard to a hypothetical rate of interest on a questionable capital structure.

German experience in the field of private forestry, however, does offer two conclusions acceptable at face value: 1. Timber can be grown commercially under private management when economic conditions demand or permit. 2. Private forest management in Germany proves that government ownership is not the answer to all forestry problems.

FOREST ESTATE DATA

By DR. FRANZ HESKE

Forest Estate Rothenhaus

1. *Situation*—Bohemia (Czechoslovakia) in the central parts of the Erzgebirge, Geographical position: 50° 25′ — 50° 40′ n. lat. 13° 15′—13° 30′ East (Greenwich). Elevation: 700-800 m. (2300-2620 ft.)

2. *Ownership*—Private forest estate in the ownership of His Highness The Prince of Hohenlohe-Langenburg. The history of the estate goes back to 1400, when a knight Dietrich Kraa is mentioned as owner. The present family has owned the estate since 1771. The first management plans starting systematic sustained working were drawn up at the end of the 18th century. The present system of working plans started in the middle of the 19th century, the plans being revised regularly since then every 10 years.

3. *Area*—A great part of the estate was expropriated in 1929. To show the effect of this alienation of well acquired and always well managed private property the areas of the estate before and after the expropriation are given in Table 1.

4. *Locality*—The ground configuration is hilly with gentle to steep slopes mostly inclined towards East-West. Geology—gneiss, michashists, clayshists, basalt, quartz and porphyry are found on certain places. The soil is generally of middle good to good quality. Two types of soil: hard mineral soil and soft swampy soils. The latter type particularly shows a good natural regeneration of spruce. Climate—Rough storms chiefly from west in autumn; deep snow in winter between October and May; from November to January, hoar frost. Rainfall—In the higher altitudes 970 mm (38.2 inches), in the lower 564 mm (22.2 inches) per year. The maximal rainfall occurs in July, August and January, the minimal in February, March and December. The lower parts of the forest are damaged by fumes coming from the coal mines of Northern Bohemia and damaging chiefly the fir forests.

5. *The growing stock*—(a) species: Spruce (*Picea excelsa*) 90 per cent of

Table 1

	Areas Prior to the Expropriation Hectars	Acres	Area Left After Expropriation Hectars	Acres
Farmland	2128.6	5230	499.3	1248
Forests	8646.4	21620	5580.1	13950
Parks	290.3	726	293.3	726
Garden	6.4	16	6.4	16
Total	11071.7	27682	6376.3	15940

Hence: 1629.3 ha 4072 acres Farmland or 71.6 per cent
3066.3 ha 7620 acres Forests or 35.5 per cent
4695.6 ha 11742 acres in total or 42.4 per cent
have been expropriated. Compensation about 12-15 per cent of the real value.

the area; beech (*Fagus silvatica*) 3 per cent of the area; the rest: Larch (*Larix europaea*), Scotch-pine (*Pinus silvestris*), Oak (*Quercus sessiflora*), Fir, (*Abies pectirata*), etc.

(b) Quality class: average: 3 (according to Schwappach).

(c) Proportion of age classes: 1-20 years old forests: 14.9 per cent of the forest area; 21-40 years old forests: 17.7 per cent of the forest area; 41-60 years old forests: 15.9 per cent of the forest area; 61-80 years old forests: 19.8 per cent of the forest area; 81-100 years old forests: 26.9 per cent of the forest area, and older. Blocks under regeneration, 1.7 per cent of the forest area; Blanks, 4.2 per cent of the forest area.

This proportion of age classes shows that a sustained management has been conducted since at least one rotation.

(d) Growing stock: On an area of 5269 hectars (13,170 acres), a growing stock of 76507 m^3 (19,100,000 b f) hardwoods and 1,172,286 m^3 (293,100,-000 b f) softwoods, totaling 1,248,793 m^3 (312,200,000 b f), or 237 m^3 per one hectar or 237,000 b f per one acre was ascertained. These figures comprise the so-called "Derbholz," viz: timber of 8 cm (3.15 inches) diameter and more only.

6. *Administration*—The whole forest area is subdivided into five ranges, in charge of each there is a medium-trained forest officer. In addition to these men there are five foresters and assistants (medium-trained) in the range quarters and eight forest guards. Over the whole estate is a director, a university-trained professional forester. In charge of the working plans and the forest survey is also a university-trained forester. In the head office and for the rest of the agencies, including the administration of the farmland, gardens and parks are three medium-trained officials and eight clerks available.

7. *Management* — Strictly sustained working. (a) Yield: Yield calculation according to the modern combined method of Saxony (age class method "Bestandswirtschaft.") Rotation: 100 years. All forest crops over 50 years are periodically (every 10 years) enumerated and measured.

Annual sustained yield: Final fellings: 25,880 m^3 6,470,000 bf; intermediate fellings (thinnings, cleanings, etc.,) 8,120 m^3 2,030,000 bf; total: 34,000 m^3 8,500,000 bf, or 6.5 m^3 per hectar (650 bf per acre).

(b) Regeneration—Natural regeneration where possible in strips or in group system and shelterwood compartment system. Otherwise sowing under shelter in strips proceeding against wind (from northeast to southwest). Planting of cleared areas with spacing of 4 to 5 feet.

The past management neglected to a great part thinnings. In the future a greater care has to be devoted to thinnings and cleanings and all sorts of preparatory fellings stimulating increment and regeneration capacity (crown development).

8. *Markets*—Excellent. The forest is situated near the boundaries of Germany (Saxony) and all its timber is being exported.

Count Arnim's Forest Estate

1. *Situation*—Muskau near Rothenburg in Silesia between the rivers Neisse and Spree.

2. *History*—Since the 10th century the owners have changed frequently. 1811-1845 the estate belonged to Count Hermann Puckler, who designed the wonderful park. After that the estate was for a couple of years in the ownership of the Prince of Holland. Since 1833 only the domain belongs to the Counts of Arnim. In spite of these changes the forests have been managed always in a sustained way which shows that ownership over many

generations in one family however important for a certain permanency in management is not its deciding essential. Since 1860, under permanent working plans revised every 10 years. Saxony-Method of yield calculation.

3. *Area*—255,560 hectars, 63,900 acres forests; 527 hectars, 1,317.5 acres park; 725 hectars, 1,812.5 acres farmland; total, 256,812 hectars, 642,030 acres.

4. *Locality*—Geology: Morain country. Tertiary, dilluvial and alluvial deposits. Brown coal mines. Soil: Sand, loam, clay, gravel and swamp ground. Configuration: undulating rolling country; elevation, 100-160 m (328-525 feet); climate; rainfall 60 mm (23.6 inches).

5. *Growing stock*—Species: 97 per cent Scotch pine (*P. sylvestris*); rest, spruce (*Picea excelsa*), oaks, birch and other hardwoods.

Rotation: 100 years.

Proportion of age classes of the total forest area are:

Blanks, 0.8 per cent; 1-20 years old, 22.2 per cent; 21-40 years old, 12.4 per cent; 41-60 years old, 16.8 per cent; 61-80 years old 20.6 per cent; 81-100 years old and more, 27.2 per cent, which distribution proves that sustained management has been conducted for a long time.

The total growing stock has been ascertained as being 3 million fm or 750 million bf, which means 126 fm^3 per hectar of the forest area, or 12,600 bf per acre.

6. *Yield*—70,150 fm^3, 17,537,500 bf. "Derbholz" timber over 8 cm, 3.15 inches in diameter. This means 2.9 fm^3 per one hectar, or 290 bf per acre of the forest area.

This annual yield is 60 per cent final fellings, 40 per cent thinnings.

It consists of 50 per cent construction timber and saw logs; 38.6 per cent pulpwood, 4.3 per cent pitprops, and 7.1 per cent firewood.

7. *Management*—Narrow clear fellings (strips) about 120 feet wide. Besides also selection system. Regeneration: 1/3 natural, 2/3 artificial. Broadleafed species are brought in to obtain mixed forest.

Thinnings and improvement fellings very intensive because all the small material is used in the domestic pulp factories.

Regeneration expenses: 100 to 120 Reichsmarks per hectar, viz: Preparation of soil: 60-70 Reichsmarks, cost of plants, 16 Reichsmarks, labor, 20 Reichsmarks. They plant one-year-old Scotch pine. All plantations are fenced against deer. Cost of fencing, per one current meter, 30 Pfennigs labor plus 10 Pfennigs poles, wire fence, 0.80 to 1.00 Reichsmarks per current meter.

8. *Utilization*—(a) Markets excellent because the forest is opened by a network of permanent roads, one forest railway and thus connected with the public transport system. A good many of the logs are sawn in the domestic sawmill, a great part of the pulpwood is used in the domestic pulp and cardboard factory and the pitprops are used in the Count's coal mines.

The average timber price in the last year: 16 Reichsmarks per one fm^3.

Recently they have introduced a wood gas generator for timber transport, which works with about 30 per cent saving in comparison with the ordinary Ford tractor. Per 8 hours the generator consumes 2 centners (181.44 lbs.) firewood and works with only half of the costs of a horse team.

(b) *Industries*—Several cardboard factories with a total daily production of 50-60 tons of cardboard. They consume about 57,300 fm, 1,003,750 bf pulp wood, one-half to two-thirds of which are from the Count's own forests, the rest so far

over-stepping the sustained yield, being purchased from outside.

9. *Forest Protection*—Insect calamities: 1906-1908 the *Bombyx pini*, a moth, destroyed about 2500 acres of forests. Other destructive insects: *Panolis pini perda* and *Liparis monacha*.

Fire danger is very important. Ten fire lookouts. The forest is intersected by a network of compartment lines serving as fire line.

10. *Administration*—The forest area is divided into four districts which again are subdivided in 23 ranges. The average area of one district being 6400 hectars, 16,000 acres. Average area of one range, 1100 hectars, 2750 acres. Forest staff: Five university-trained forest officials (chief forest manager and four district officers). Medium-trained foresters: 23 range officers, four secretaries with the district officers; 15 forest guards and lower forest officials. Total, 51 permanent forest officials and 378 forest laborers. 20 officials and clerks. 200 laborers.

Sawmill in Weisswasser: Five gang-saws, one planing machine, 50 laborers. Saws annually 11,000-13,000 fm^3, 2,750,-000-3,250,000 bf logs. Utilization effect: 55 per cent.

Analysis of costs per 1 m^3 logs: Transport from the forest to the mill, 10 per cent; price of the logs, 55 per cent; salaries and wages, 20 per cent; miscellaneous, 15 per cent.

Cost of the logs at the sawmill, 12.64, 100 per cent; cost of sawing in the mill, 7.30 (3.30 wages, 1.00 salaries, 3.00 other expenses).

Costs per m^3 logs, 20.—RM.

From 1 m^3 logs 55 per cent lumber (boards, construction lumber) is being sawed.

Hence costs per 1 m^3 lumber 42.—RM. In 1932-33 a m^3 of lumber could be sold for only 42.60 RM, in 1931-32 for 44.00 RM. In 1927-28 the costs were 66.65 Marks. The price of the lumber 74.00 Marks, only 15 to 20 per cent are boards, the rest is construction timber.

Of the 35,000 m^3 logs cut in the forest for construction timber, boards, etc., only 20,000 are being sawn at the own mill. 15,000 m^3 are sold as round timber in order to keep contact with the market conditions.

In Keula is a second mill, which is using also 10,000 m^3 of logs. The small railroad has 77 km tracks (mainly for lignite). Net profit: 3 Reichsmarks per one fm^3—250 bf.

11. *Social importance*—The forest and park and farmland plus the permanent forest industries supply permanent living for 147 officials and 849 laborers (altogether 2,161 men, including folks dependent on them).

12. *Game*—Of the forest area are 2,500 hectars (6,250 acres), a fenced deer park containing red deer, roe buck, wild boar, rabbits, etc., while there are on the estate besides these species, partridges, pheasants, capok, woodcock, hares, wild ducks, etc.

Forest Estate Neschwitz

1. *Situation*—Saxony Germany, near Bautzen.

2. *Ownership* — Private forest estate owner: The Baron von Vietinghoff-Riesch, since 1763 in the hands of the present owner.

3. *Area*—1,660 hectars (4,150 acres) of which 933 hectars (2,330 acres) forest.

4. *Locality*— (a) Geology: Dry rough gravel soils, sandy on some places, clayey.

(b) Rainfall: 690 mm (27.2 inches) per year; maximum (1926): 990 mm (39.0 inches) minimum (1924, 1929, 525 mm (20.7 inches).

5. *Species*—88 per cent Scotch pine (*Pinus sylvestris*), 7 per cent spruce (*Pi-*

cea excelsa), 3 per cent oak (*Quercus sessiflora*), 2 per cent various hardwoods.

6. *Proportion of age classes*—1-20 years, 24 per cent of the forest area; 21-40 years, 18 per cent of the forest area; 41-60 years, 17 per cent of the forest area; 61-80 years, 32 per cent of the forest area; 81-100 years, 8 per cent of the forest area; blanks, 1 per cent of the forest area, which proves a sustained working since a long period.

7. *Quality classes*—Pine forest: 1 per cent of the area, I. quality class; 21 per cent of the area, II. quality class; 28 per cent of the area, III. quality class; 38 per cent of the area, IV. quality class; 12 per cent of the area, V. quality class.

8. *Yield*—4,000 fm^3, 1,000,000 bf, or 4.3 fm^3 per hectar (430 bf per acre).

Out of this volume 75 per cent are timber over 8 cm diameter (3.15 inches) so-called "Derbholz," 50 per cent are timber, 50 per cent firewood. About 1,000 fm^3 or 250,000 bf are sawn in a small mill belonging to the estate, the rest is sold as construction timber, pitprops, telegraph poles, etc. Fire wood is readily sold because of the scarcity of forests in neighborhood. Transport costs from the forest to next railway station 2.50-3.00 Reichsmarks per one festmeter (250 board feet).

9. *Timber prices* — Average timber prices: 10 Reichsmarks per one festmeter (250 board feet).

Timber prices in the past: 1912-1914, 12 Reichsmarks per 1 festmeter; 1927-1929, 18-19 Reichsmarks per 1 festmeter; 1930, 15 Reichsmarks per 1 festmeter; 1931, 12 Reichsmarks per 1 festmeter; 1933, 10 Reichsmarks per 1 festmeter; pitprops, 15 Reichsmarks per 1 festmeter; firewood, 6-7 RM. per one Raumeter.

10. *Labor*—Eight permanent forest workmen families. Besides 14 not permanent in the winter. Middle wages: 0.40 Reichsmarks per hour. (A good workman paid per piece may earn 0.60 Reichsmarks per hour).

11. *The Administration*—The estate is managed by the young Baron, who himself is a university-trained forester. Besides there are one accountant (high school), two medium trained foresters, one forest guard.

12. *Working Plans*—Modern combined method of Saxony. (Age class method "Bestandeswirtschaft").

13. *Silviculture*—Formerly clear felling system with artificial regeneration. At present, where possible, natural regeneration, where artificial regeneration necessary soil preparation (ploughing) applied.

Expenses for artificial regeneration: 0.54 Reichsmarks per hectar of the total forest area.

Thinnings repeated every five years, amounting to about 18 festmeters per hectar of thinned area.

14. *Forest protection*—Insect calamities very frequent. Systematic methods to multiply the population of birds which check the insects have been particularly well developed on this estate.

15. *Finance*—Gross income, 37,000 RM. (37. per hectar) in 1932; 48,700 (52. per hectar in 1933.)

Costs, 33,500 RM. (33 per hectar) in 1932; 34,000 (37. per hectar) in 1933.

Analysis of costs: Cutting timber, 22 per cent; plantations, 1.5 per cent; timber extraction, 11.0 per cent; administration salaries, etc., 38.0 per cent; miscellaneous, 11.5 per cent; taxes, 15.5 per cent.

The total estate (forests and farmland) supplies permanent labor for 40-50 laborers.

Fig. 1.—Several members of the party in the forest of Graf Holnstein. Scotch pine (near Dresden).

Fig. 2.—Typical well spaced hardwood forest. Tharandt (Saxony).

Fig. 3. — Harvesting spruce in Czechoslovakia.

g. 4.—In Count Von
nim's lumber yard.

g. 5. — Pulpwood
cutting.

. 6.—Pulpwood on
road, drawn by
od-gas tractor.
unt Arnim's forest.

NATIONAL FOREST REGULATION G-20A

By C. E. RACHFORD

Assistant Forester, U. S. Forest Service

On March 29, 1934, the Secretary of Agriculture approved and put into effect a new National Forest Regulation, known as G-20A. This marks a distinct new departure in federal policy toward the wildlife resources of the national forests. Heretofore the U. S. Forest Service has recognized that fish and game animals were subject in their protection and use only to state law and regulation. Under that conception the functions of the national forest officer were limited to coöperation with the state game official in the performance of his duties. As the years have gone on, the thought has steadily gained strength that the wildlife is just as integral a part of the whole national-forest resource as are the timber, forage, and recreational facilities. The failure of states to redeem their responsibilities on many areas has served finally to crystallize this thought into action in the form of the above-mentioned regulation, which is quoted in full below. Assistant Forester Rachford gives us herewith his size-up of the situation. Seth Gordon, President, American Game Association, expresses his doubts as to the workability of the regulation, and Elliott S. Barker, President, Western Association of State Game and Fish Commissioners argues against it.

WHEREAS, wild life is one of the major resources of the national forest land and water, and its management and development are an essential part of the administration of the national forests; and

WHEREAS, the prevention of overgrazing and erosion and the protection of watersheds, timber, and other resources are dependent upon the regulation of wild life population to the carrying capacity of the land or water, and such regulation is also essential to maintain the productivity of such land and water for wild life; and

WHEREAS, the regulation of wild life population by hunting and fishing is the most effective means of limiting the population to the carrying capacity of the range or water and of disposing of any excessive numbers; and

WHEREAS, the regulation of hunting and fishing on the national forests is effective in reducing the fire hazard and in promoting the conservation, development, and proper utilization of national forest resources; and

WHEREAS, plans for the development of the wild life resources, including the regulation of hunting and fishing, should be closely harmonized with the plans and objectives for the management of other national forest resources to insure the maximum public benefits;

NOW, THEREFORE, by virtue of the authority vested in the Secretary of Agriculture by the Act of Congress of February 1, 1905 (33 Stat. 628), amendatory of the Act of June 4, 1897 (30 Stat., 11), I, H. A. Wallace, Secretary of Agriculture, do hereby make and publish the following regulations for the occupancy, use, protection, and administration of the national forests:

REG. G-20 A. When the Secretary shall determine upon consideration of data and recommendations of the Forester that the regulation or the prohibition for a specified period of hunting and fishing upon any national forest or portion thereof is necessary for the accomplishment of the purposes above set forth, he shall designate such national forest or portion thereof, establish hunting and fishing seasons therefor, fix bag and creel limits, specify the sex of animals to be killed, fix the fees to be paid for permits, designate the authorized official to whom application for permit shall be made, and describe the terms and conditions under which hunting and fishing shall be conducted with a view of carrying out the purpose of this regulation

ublic notice of such designation shall be ven by such means as the Forester shall eem adequate for the purpose. Carcasses animals or fish taken under permit all be marked or tagged for identifica- on as directed by the Forester.

Reg. T-8½. Upon national forest lands esignated under Reg. G-20 A the follow- g acts are prohibited:

Hunting, fishing, trapping, catching, disturbing, or killing any kind of game, non-game, or fur-bearing animals, game or non-game fish, or game or non-game birds, or taking the eggs of any such fish or bird, except during the hunting, trapping, and fishing seasons established by the Secretary, and in accordance with the terms and conditions of a permit issued by a duly authorized officer, which is valid and subsisting at the time.

ON a certain national forest in one of the western states there is an area admirably suited to production of er. It is adjacent to a large agricultural ea and to several small settlements. The ea includes both winter and summer nge. On this area, however, deer are ex- edingly scarce. Under existing state law, e kill during the open hunting season, ded to the number killed by poachers, has most exterminated the herd. The crying ed in this particular case is protection r the deer by the closing of the area to nting. State game officials have been mpathetic with the recommendations of cal forest officers for the creation of a te game refuge. A number of the citi- ns have, through petitions, indicated their proval. But in furthering that objec- e, forest officers were accused of politi- l activity by another faction of the citi- ntry. The influence with state legislators those opposing the plan was sufficient block the establishment of the refuge. sult: Wildlife on that area continues on decline.

Ten years ago, through the efforts of est officers, a state game refuge was ablished on another national forest. rough the coöperative efforts of forest icers and state game officials, a deer herd s built up from a comparatively few imals to about 900 head. The area was proaching a fully stocked condition, and local forest officers were agreeable to a limited kill. But because of a clamor for hunting privileges by the citizens around the area and the inability of the state game administration to regulate the kill, the area was thrown open to hunting under the regular season of the state. Result: Every man, woman, and child for some distance around who was capable of carrying a gun flocked to the area during the open season. The herd was reduced to a number of animals approximating the number which were on the area when the refuge was established. Ten years of work and effort were lost because of the inadequacy of state game laws.

On yet another forest, through protective measures both as to hunting and the control of predatory animals, a deer herd increased far beyond the capacity of the range. The indications of overstocking were first discovered in 1919, but it was not until 1927, eight years afterward, that any effective measures were taken to control the number of animals. And this was brought about only by a suit in the courts, which was carried to the Supreme Court. Result: The natural game food on the area was reduced to about 10 per cent of its original productivity. Conifer reproduction was greatly injured. Aspen reproduction was wholly absent, and the future production of the area for timber purposes was impaired. Thousands of deer died of

starvation.

The conditions prevailing on this area focused attention on conditions prevailing on many other forest areas. Careful examinations of numerous areas by representatives of different agencies interested in the welfare of the forest and game revealed different degrees of utilization, and in many cases a fully stocked condition. Through the coöperative efforts of the Forest Service and the state game wardens, some of these areas were relieved by opening refuges to hunting, but in a much larger number of instances no such action was possible. Result: Two and a half million acres of forest land are now approaching conditions of acute overstocking. Elk, antelope, and deer feed is being progressively destroyed. Timber reproduction is suffering, and various forms of erosion taking place.

For a number of years biologists and foresters have been greatly concerned over what is happening to the range of one of our most important elk herds. The evidence is clear that the range is overstocked and that large losses occur from starvation. State officials acknowledged the conditions and the need of regulation. Plans were developed to apply regulated hunting, but it was found on closer examination of the state law that all licenses had to be issued by the Director of Licenses and that he had no authority to limit the number so issued. Since the plan had to be postponed, no action will be taken this year and both elk and range must continue to suffer.

Examination of many of the mountain meadows on national forests has proved pretty conclusively that they were originally made by beaver. Trapping, under state laws which were based largely upon the judgment of local trappers or men without the necessary biological training, exterminated the beaver from many areas and almost exterminated them from many others. Result: Dams gradually gave way. Channels were widened and deepened. The water table was lowered; the meadows were heavily grazed and converted into erosion scars. Such conditions are not beyond repair, providing the areas can be restocked with beaver, adequate protection afforded, and a little common sense applied in maintaining numbers of animals. There is no assurance, however, that such protection can be afforded for any given length of time under the existing game laws of many of the states.

The above illustrations are only a few among many that might be cited as indicating the results of inadequate provisions for game management on the national forests. There are wildlife problems of one kind or another on every national forest. Countless examples of such problems might be cited to show the need for better coördinated resource plans. The Forest Service has attempted to meet this situation through coöperation with state fish and game commissions. That policy has secured very definite results. While it has generally increased the number of big-game animals on the national forests, its limitations are indicated by the foregoing illustrations.

Regulation G-20 A was therefore developed as a means of meeting a situation which time and experience have proved could not be satisfactorily met under past policies of coöperation. It attempts to place in the hands of a responsible agency the necessary responsibility for the correction of an evil. It is devised to aid and improve coöperation in all cases where inadequate state law or the pressure of selfish interests prevents the action which should be taken. It may be said that in most instances state game officials are sympathetic toward the needs and would if unencumbered by other considerations agree to and apply the necessary remedies. Their hands, however, are largely tied and will remain so until sane and workable state laws are enacted. In the meantime,

the application of Regulation G-20 A provides a remedy and may give an impetus to the enactment of constructive state laws.

There has been some question as to the validity of the regulation. Lawyers disagree. On the advice of the Solicitor of the Department of Agriculture, however, the regulation was developed. It was held that the Secretary of Agriculture has the same authority to regulate hunting and fishing on the national forests that he has to regulate grazing. Rather than an infringement on state rights, as some allege, Regulation G-20 A is a measure developed to protect public interests, which are not now being protected under state laws.

Since lawyers differ as to the validity of the regulation, and since there is an imperative need for a definition of responsibility, it would be to the interest of all concerned if the regulation is subjected to a test in the courts. In the absence of such a test case, Regulation G-20 A should be applied when and where conditions justify its application. The Forest Service is responsible for the growth and utilization of timber and forage on the national forests. It has a distinct responsibility to see that all legitimate uses of forest land are fostered and coördinated. Unless means are available by which the same principles can be applied to wildlife that are applied to other resources, the responsibility of the Forest Service as a land manager cannot be met.

IS IT WISE? WILL IT STICK?

By SETH GORDON

President, American Game Association

THE promulgation of Regulation G-20 A by Secretary Wallace has caused considerable discussion, and some apprehension, among state wildlife administrators and leaders of conservation groups.

Having been a state game administrator myself for thirteen years, and having kept in close touch with these officials throughout the United States for almost twenty years, I believe I know something about their problems, and can appreciate their line of reasoning.

In some quarters this new regulation has been hailed as a timely recognition by the Department of Agriculture, or its Forest Service, that the management and production of wildlife crops on our forests is equally as important as the production of saw-logs, the protection of watersheds, or the management of grazing.

In other quarters, mostly among game administrators, the regulation has been received with fear lest it presages ultimate usurpation and federal domination of state rights in the management of wildlife, whether resident or migratory, on our national forests. And if on national forests, what will be the relationship on the extensive purchases of other lands now being made by the Federal Government?

One school of thought holds that only the federal administration is stable enough, and far-sighted enough, to assure the necessary long-term management of wildlife resources on federal lands, and that the loosely knit coöperative methods of the past are obsolete. They hold also that ultimately they may find it necessary to resort to selective harvesting of certain surplus game crops by paid public servants as is done in Europe.

The other school believes that the coöperative method will in the end produce

the most satisfactory results, and that the assumption of all game managerial responsibility on federal lands by the government (the landowner) will weaken materially the state game administrative fabric. They fear also that it may open the door to private ownership of public game and fish on all lands, except those in state ownership.

While everyone conversant with past practices has absolute confidence in the ability and integrity of the Forest Service and its employees, assurances that this new regulation will be applied only where the states fail to assume their responsibility have not allayed the fears of state game administrators. Probably the terse legal phraseology of the regulation was somewhat unfortunate.

The big question in the minds of most skeptics is: Who shall determine whether the states are measuring up?

The answer is obvious. The Forest Service, of course; probably with the aid of the U. S. Biological Survey.

I sincerely believe the Federal Government should never attempt to assume the authority conferred by Regulation G-20 A until every reasonable effort has been exhausted to have the states do an efficient job themselves. With proper federal coöperation, they will invariably be able to handle internal wildlife problems fully as well as the Federal Government can do it for them.

The application of this regulation on the national forests of the West, which never were in private ownership, and where the states have become accustomed to having Uncle Sam do many things for them, is one thing. Its application on the recently acquired national forests of the East, where conditions are quite different, and where in some cases Forest Service officials promised never to dictate wildlife management practices in order to obtain legislative consent to buy the forests, is a different matter entirely.

There is just enough merit on both sides of the argument to assure a real court battle if any state ever musters courage enough to test Regulation G-20 A in the courts, as Mr. Rachford hints may be necessary to decide its validity.

A GAME OFFICIAL'S VIEWS OF REGULATION G-20-A

By ELLIOTT S. BARKER

State Game Warden for New Mexico, and President, Western Association of State Game and Fish Commissioners

THE western states are appreciative of all coöperative work done by the Forest Service in furtherance of wildlife protection, propagation, and management on the national forests of the western states. We feel that such coöperation is proper and should be continued. We have confidence in the personnel of the Forest Service, and desire to make it clear to all that this discussion of Regulation G-20-A is in no way a reflection upon the ability and integrity of that organization.

Having been a ranger and supervisor in the Forest Service for ten years, a rancher and permittee on a national forest for a like period, for one year in charge of game and fish on a 400,000 acre private game park, and for nearly four years at the head of the New Mexico Department of Game and Fish, I believe I can look at the situation without prejudice. The legal aspects of Regulation G-20-A must be determined by the courts or preferably by action of the Congress. But let us look for a moment at the practical side from an administrative stand-

point. Suppose the Santa Fe Forest, for example, or any other forest, for that matter, were so designated and seasons, bag limits, etc., for game birds and fish, were established by the Forest Service different from state regulations. The forest boundary is very irregular dividing streams and hunting units; within the forests are many privately owned lands, and fishing streams are alternately on forest and private lands. With dual control separate licenses, different bag limits, conflicting seasons, etc., for intermingled forest and private lands, administration and control by either the State or Forest Service would be utterly impossible and unlimited confusion and conflict would result. Instead of better control the sportsmen would be confused and hampered by dual control and conflicting regulations. Not only that, but if by virtue of land ownership the Forest Service can control hunting, charge fees, set seasons, fix bag limits, etc., by the same token the owners of private lands can do the same thing. Therefore, if Regulation G-20-A were applied we would not only have the burdensome difficulties of dual control to contend with but it would soon break out into a multiplicity of regulations which would soon break down all control, and put the state game and fish departments out of business.

There is yet another phase of the situation that should not be overlooked. Mr. Rachford has cited a few examples of needed action to produce more game on the one hand and to reduce game populations in other instances. In fairness we believe Mr. Rachford should also have mentioned the existence of numerous cases on national forests where big game as well as game birds are extremely scarce due to excessive utilization of the forest forage and cover by livestock. Over-use and injudicious use of ranges by livestock, especially on the higher inaccessible game range types, is far more common than overpopulation by game. Furthermore, usurpation of game ranges by permitted livestock is a most common cause of game scarcity. Until such time as proper adjustments have been made in grazing control on the national forests so that ranges primarily suited to game production are devoted to that end Regulation G-20-A is doubly out of place.

On the Kaibab Forest, where court action was resorted to to secure a reduction of game animals the committee representing many national conservation organizations made a most significant recommendation as a result of a field inspection in 1931, namely "That all unpermitted livestock be removed," and it was agreed that "the original stand of palatable plants has been reduced by 90 per cent by the *heavy grazing* in the early days by *domestic stock* and later on by herds of deer."

Mr. Rachford deplores the opening of a refuge where a good supply of deer had been built up and resultant reduction of deer under the regular hunting season to approximately the original number. Yet in New Mexico the Forest Service has for the past three years been vigorously insisting upon the opening of many of our big game refuges in like manner. Such policy if followed would mean ultimate reduction of game to a minimum. Fortunately, and in fairness to all, I wish to state that the local policy seems to have changed somewhat during the past year.

Most of the states have progressed rapidly in the past few years in game administration matters and are equipped with regulatory power to handle game matters efficiently. If any are lagging behind and have not progressed to this point, would it not be better for the Forest Service and other organizations to loan an effective helping hand to secure needed legislation rather than to attempt to take over control as contemplated by Regulation G-20-A?

HOW MUCH TIMBER HAS AMERICA CUT?

BY R. V. REYNOLDS

This article describes an attempt to measure the quantity of timber cut in the United States for commodity use during the 300-year period between 1630 and 1930. In the absence of other similar estimates the results may be of sufficient interest to warrant publishing the findings.

The author desires to emphasize that high accuracy is not claimed for these figures. No amount of computation can make up for the lack of recorded facts. The results shown are based on data, some of which are incomplete or imperfect, modified and developed by factors many of which can not be verified, while those for the earliest decades must be rated as little more than careful guesses. Fortunately the decades where the greatest uncertainties exist contribute least to the total. For that reason the enormous size of the saw-timber cut may be justified, even though it exceeds by two trillion board feet the figure of 5.2 trillion feet commonly used as the estimate of original stand. Unless the estimated cut of 7.2 trillion feet is seriously in error, it seems probable that the original stand was more than eight trillion feet. Growth and damage figures running into fewer but comparable trillions probably also should be regarded as part of the American forest history.

THE old time lumberman had no conception of driving safely at 70 miles an hour on the highways. The present generation may have little better understanding of the facts of stand and growth as they existed before fires destroyed the forest floors of the East, and erosion drained away the normal water and fertility. Few people now remember the quality and general utility of northern white pine as it was forty years ago. Still less can they visualize from present evidence the stand and growth of hardwoods forty years earlier on the fertile soils which are now our farm lands. Our present conception of the amount of damage done before 1900 by fire in heavy stands of softwoods is possibly just as inadequate. There was an old saying that more timber was destroyed than ever was utilized.

METHOD USED

The basic quantities of the four commodity classes, shown in Table 1, were first reduced to a common basis of cubic feet. These figures, for commodity cut, in cubic feet, by decades, were next reduced to saw timber by application of the percentages shown in the first section of Table 2, and suitable conversion factors. The percentage of each commodity allotted to saw timber at the earliest date shown was set at a point which seemed reasonably high relative to the 1930 figures on account of the general availability of saw timber in the past.

The saw-timber quantities were then divided into softwood and hardwood by application of the percentages shown in the second section of Table 2. The percentages of hardwood in saw timber were also set relatively high for Fuel and All other at early dates for reasons stated near the end of the text. The hardwood percentage for pulpwood is of record in 1880 and for lumber in 1900. The earlier lumber percentages are based largely on the author's conception of the probable use of sawed hardwoods during a period of change from pit-sawing and water power mills to the general use of steam power.

The resulting data made possible the plotting of the four diagrams. The plotted points are at the decade points only. The upper curve on each diagram approximates the sum of those below it, but discrepancies may be detected, especially between the decade points, where some license in sketching was taken, and some minor drafting errors occur. Planimeter measurements on the diagrams,

supplemented by the numerical data, gave the basis for Table 3 and for the small unnumbered tables on the diagrams, which show computations for the 170 years preceding the diagrams, as well as for the diagrams themselves.

Results

The results of these statistical operations run into figures so large that they are meaningless unless resolved into units which the ordinary mind can grasp. Refering to the total volume shown in Table 3, let us imagine twelve cubes of solid wood, each measuring a mile on the edges.[1] The wood in these cubes is the usable stems, the tops, and the limbs of all the trees cut for commodity use in 300 years. (We are thinking now of total volume, not saw timber.)

Seven of the cubes were cut to make fuel, three for lumber, and two for all other commodities, including pulpwood.

Ten of the cubes include both saw timber and cordwood, cut from trees of saw-timber size: the other two are solely cordwood, cut from cordwood trees.

Eight of these cubes of total volume are hardwood and four are softwood.

The lumber which could be sawed from all this timber, if solidly stacked, would make between four and five cubic miles,

Table 1

COMMODITY CUT, BY DECADES
(Read millions)

Period	Fuelwood[1] Cords	Lumber[2] Feet b.m	Pulpwood[3] Cords	all other[4] Cubic feet
1630-1800	1,474.000	25,000	———	12,000
1800	27.540	300	———	212
10	34.385	400	———	290
20	42.902	550	———	384
30	50.748	850	———	515
40	60.535	1,604	———	683
50	76.711	5,392	———	1,044
60	101.901	8,029	———	1,415
70	119.746	12,756	.002	1,735
80	150.434	18,091	.041	2,407
90	177.812	27,039	.583	3,570
1900	177.189	35,078	1.617	4,350
10	119.366	44,510	3.208	4,490
20	86.340	34,552	5.015	3,880
30	61.467	32.000	6.100	2,533

[1]Domestic and industrial fuelwood. Based on the population and a per capita cut decreasing from 5 cords in 1800 to .5 of a cord in 1930. See "Resurrecting a Forest Monster," *American Forests*, September, 1933.

[2]Bureau of the Census, 1870-1920. Remainder are author's estimates, based in part on Census valuations.

[3]Domestic pulpwood, reported by Bureau of the Census.

[4]Quantities for 1910, 1920, and 1930 based on Forest Service figures. Previous decades are author's estimates, based on population and a decreasing rate per capita. Includes such items as ship timbers, fence rails and posts, hewn ties, timbers and mine timbers, cooperage stock, logs for building construction, export, and veneer, poles, piling, shingles, vehicle and furniture stock, and wood for charcoal, pearl ash, and other products of distillation, tanning extract, and excelsior.

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[1]Another geometrical conception of this total volume would be a steep sided, pyramidal mountain range, a mile high, a mile through the base, and about 25 miles long. Yet if evenly distributed, this wood would cover the vast forest area from which it was cut in a layer less than an inch in thickness.

of which hardwoods would constitute slightly more than half.

Other indications appear in Table 3 and in the four diagrams which follow. Certain of these indications seem worthy of especial mention.

It appears that the peak of volume in timber cut (see Fig. 1) occurred in 1900 —five years before the Forest Service was established by President Theodore Roosevelt. The decline in cut since 1900, due mainly to the use of coal, petroleum, steel, and concrete, came concurrently with the exhaustion of forests located relatively close to the great consuming centers of the Northeast.

This decline is narrowing the gap between total drain on the one hand and timber growth on the other, aided by such helpful results as may have come from better utilization, wood preservation, and the reduction of fire and other damage. In the case of saw tmber, unfortunately, the gap is much wider than in the case of total volume. Apparently many years must pass before growth can offset normal saw timber drain.

The small volume of domestic pulpwood is in striking contrast with that of both fuel and lumber. Domestic pulpwood is more than half of the wood used in an industry the products of which have a value comparable to those of the lumber industry itself. Yet the latter requires many times as much wood. (Fig. 1.)

The cut of fuelwood dominates both the diagrams and the table (Fig. 1, Fig. 3, Table 3). More timber has apparently been cut for fuel than for all other commodities combined. It was the fuel cut and the clearing of agricultural land that swept away the bulk of our hardwood timber. Lumbering and forest fires principally accounted for the softwood saw timber. Fully three-fourths of the saw

TABLE 2

CONVERSION FACTORS APPLIED TO BASIC QUANTITIES, COMMODITY CUT
(*Percentages*)

	Portion of volume from saw timber				Portion of saw timber from hardwood			
Period	*Fuel*	*Lumber*	*Pulpwood*	*All other*	*Fuel*	*Lumber*	*Pulpwood*	*All other*
1630-1800	90	100	—	95	70	10	—	70
1800	90	100	—	95	75	12	—	72
10	90	100	—	95	76	13	—	75
20	90	100	—	95	77	14	—	77
30	89	100	—	95	78	17	—	78
40	88	100	—	94	78	20	—	80
50	87	100	—	93	78	24	—	80
60	84	100	—	90	77	28	—	80
70	80	100	—	86	75	28	—	79
80	75	100	70	82	74	27	23	76
90	67	100	65	78	69	26	22	73
1900	50	100	60	73	60	25	19	70
10	35	100	55	70	50	24	13	65
20	28	100	50	65	45	21	11	60
30	23	100	50	67	41	19	10	57

Percentages for 1930 are based upon data used in the preparation of Table 13, "A National Plan for American Forestry." For 1920 similar use was made of the corresponding table in the Capper Report.

In converting fuel a deduction of 15 per cent was made in each decade for bark and utilized waste. In converting pulpwood a deduction of 10 per cent for bark was made. Fuelwood cord = 95 cubic feet volume. Pulpwood cord = 117 cubic feet volume. Saw timber content of cordwood: A cord cut from saw timber = 500 feet b.m. Conversion of lumber (only) to volume standing timber (excludes bark) Hardwoods: 1,000 feet b.m. = 242 cubic feet. Softwoods: 1,000 feet b.m. = 183 cubic feet.

timber was cut since 1860 (Fig. 2, Fig. 4). Thus the bulk of the deforestation of America took place within a little more than a normal lifetime.

The peak cut of hardwood saw timber (Fig. 4) was about 1887, nearly half a century ago, when oak and yellow poplar were at the climax of use for lumber and other purposes. It was not until 20 years later, in 1907, that softwood saw timber apparently reached its highest point, coincident with the peak of lumber production. The indications are that as recently as 1870 the hardwood saw timber used for all purposes was twice as great as the softwood cut. About 1897 they were apparently equal. In 1930 the softwood cut was more than twice that of hardwoods. In our wood utilization we have shifted in decisive fashion from hardwoods to softwoods.

Table 3 indicates a total saw-timber cut of more than seven trillion board feet, 57 per cent of which was hardwood, used so largely for fuel. The most recent official table of annual saw-timber cut,

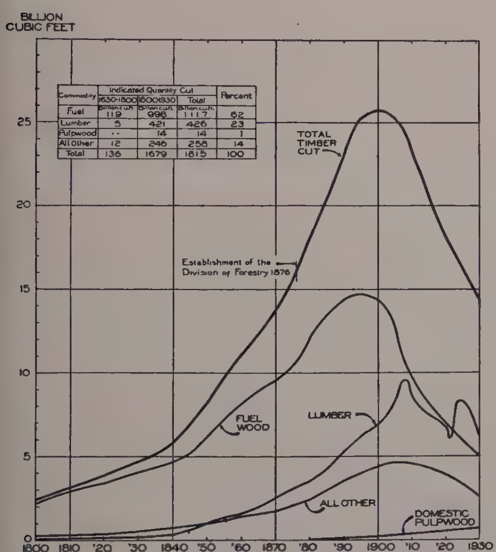

Fig. 1.—Total volume cut by commodities

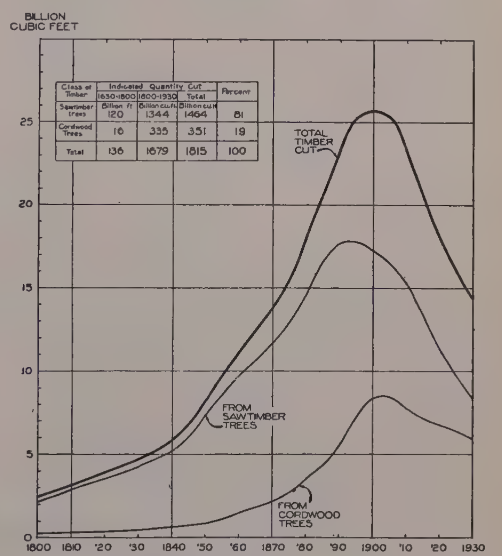

Fig. 2.—Total volume by class of timber

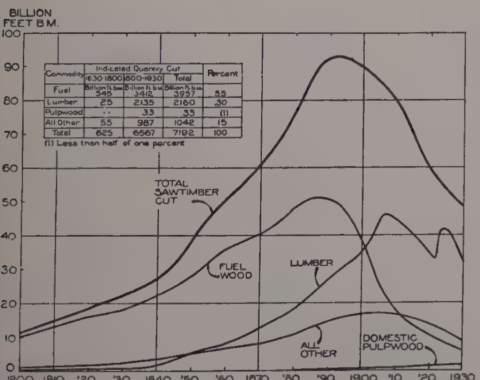

Fig. 3.—Sawtimber cut by commodities

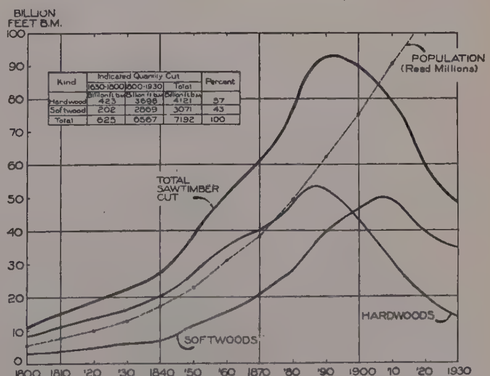

Fig. 4.—Sawtimber, softwood and hardwood

on the contrary, shows hardwoods only 26 per cent of the total. (Cf. Table 13, "A National Plan for American Forestry.") This difference is due to the change which has taken place in the utilization of wood since the days when wood was the only fuel, when hardwoods were used instead of iron, and when such iron as was used was smelted by the use of great quantities of hardwood charcoal. There was a time when the location of a smelter was determined by the chance to control hardwood timber, just as the coal supply is now a governing factor.

Table 4 indicates what now seems an enormous per capita use of wood in the earlier decades when high-grade timber was plentiful, and was practically the only material available to the bulk of the population for construction, for implements, and for fuel. The relatively heavy utilization of hardwoods in the early part of the nineteenth century is due largely to the fuelwood need and the availability of hardwoods on the agricultural lands of the East. The increase of the softwood per capita rate about 1850 is attributed to the popularity of softwood lumber as the introduction of steam power for both manufacture and transportation made it plentiful. Cheap and plentiful iron made possible the transition from the log cabin to the frame house, and from the fireplace to the stove.

TABLE 3

TIMBER CUT IN THE UNITED STATES, 1630-1930
(*Read billions*)

Commodities	Total volume			Saw timber trees			Cordwood trees		
	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total
	Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Feet b.m*	*Feet b.m*	*Feet b.m*	*Cords*	*Cords*	*Cords*
Fuelwood	248	869	1,117	1,086	2,871	3,957	.683	2.384	3.067
Lumber	302	124	426	1,648	512	2,160	-------	-------	-------
Pulpwood	12	2	14	29	4	33	.055	.008	.068
All other	62	196	258	308	734	1,042	.124	.402	.526
Total	624	1,191	1,815	3,071	4,121	7,192	.862	2.794	3.656

TABLE 4

TIMBER CUT PER CAPITA, 1800-1930

Year	Total volume	Saw timber		
		Softwood	Hardwood	Total
	Cubic feet	*Feet b.m*	*Feet b.m*	*Feet b.m*
1800	470	600	1,630	2,230
10	450	550	1,585	2,135
20	415	490	1,485	1,975
30	375	480	1,290	1,770
40	350	410	1,225	1,635
50	365	500	1,200	1,700
60	365	500	1,150	1,650
70	365	550	1,055	1,605
80	370	575	985	1,560
90	375	645	850	1,495
1900	345	625	575	1,200
10	255	545	335	880
20	175	375	195	570
30	120	280	110	390

COMMENTS

By Royal S. Kellogg
New York City

REYNOLDS has done a good job in the compilation of the foregoing figures and estimates, and it is distinctly useful to have the apparent facts presented in this condensed and simple fashion by tables and curves.

As perhaps the original sinner in the compilation of the 5.2 trillion board feet estimate of timber once standing in the United States (for the National Conservation Commission in 1908) I can sympathize with Reynolds now. We had to do a good deal of strong-arm work to round our estimates into a report based upon then existing data. The intervening 26 years have added somewhat to our information, but it is still necessary to do a lot of guessing upon the item which constitutes 62 per cent of the estimated 1,815 billion cubic feet of timber cut since 1630. This is fuelwood. I have always felt that our estimates of fuelwood consumption were too high and now that I see them totaled in Reynold's comparative columns, I am still more strongly of that opinion. Moreover, it appears doubtful to me that 83 per cent of the total fuelwood cut during the 300 years came from saw timber. Although I cannot prove it, I have a feeling that the per capita fuelwood use in the earlier days was not as great as commonly assumed, and I have a still stronger feeling that it is less today than the current estimates. A large part of our population now is in towns and cities where the amount of fuelwood used is negligible, and this is true also of much of the rural population. I travel around a good bit and I don't see much fuelwood being used in many places.

Even if the estimates of total fuelwood consumption are correct, it doesn't seem to be necessary to go back and raise our estimate of the original stand as high as 8 trillion board feet. In 300 years a lot of timber can grow to usable size, be cut and grow over again—two or three times, and this is exactly what has happened in many localities. Take the Berkshires today, for instance, they are full of fuelwood, but how many generations of timber have been cut from them? When in 1908 we set the figure of 5.2 trillion board feet of original stand, we went as high as seemed justifiable because we had to make allowances for average stands over entire states. We may not have gone high enough, but it does not seem reasonable that the estimate should be raised to 8 trillion board feet. We may be upon safer ground in cutting down the consumption estimate if we wish to arrive at a meeting point.

A look at the curves in Fig. 1 stimulates numerous questions and speculations. These curves would have been more striking were they prolonged downward to 1934 instead of stopping at 1930. A current annual lumber cut of a little more than 13 billion board feet with decreased cuts for other purposes also would bring the total down considerably further than is shown on the chart. Of course, it is not fair or within the range of probability to assume a continued downward course on the part of these wood consumption curves any more than a generation ago it would have been accurate to have assumed a continued upward course. On the other hand, it is becoming increasingly obvious to all who study the question carefully, that these wood consumption curves, after probably rising some-

what from the low level reached since 1930, will then become fairly horizontal. In this connection it is a mistake and misleading in Fig. 4 to stop the population curve prior to 1920. It, too, is rapidly changing its shape, and, according to the best-informed students of the subject, may be horizontal some 20 years hence.

Were I to venture into the realm of prediction, I would say that the trends pictured by Reynolds, coupled with a knowledge of what is going on generally in this country, afford no justification whatever for the spending of large sums of public money on poor land on the assumption that it will be a profitable undertaking to grow timber upon such land. On the contrary, I think we are justified in assuming that if the growing of timber is to give a fair return upon the investment, it must be upon land which will produce the largest and most valuable wood crops in the shortest period of time. There is a great hue and cry now about getting "marginal" land out of farm cultivation. It may be of no help to forestry to attempt to put all such land into the growing of trees.

COMMENTS

By D. M. MATTHEWS

Prof. of Forest Management, School of Forestry and Conservation

SOME pessimists will probably hail this interesting statistical presentation of the probable timber cut of America between the years 1630 and 1930 as further evidence of our inherent extravagance in the utilization of natural resources—extravagance which will bring us eventually into a condition of forest bankruptcy. Nevertheless, some interesting and rather comforting conclusions may be drawn from the data. A few of the important facts indicated are as follows:

1. The original stand of timber in the country was probably in excess of 8 trillion board feet indicating an average stand of about 10 mbm per acre for the original forest area of 822 million acres.

2. Our total cut has been approximately 7.2 trillion board feet, but 55 per cent of this was cut for fuel and only 30 per cent for lumber.

3. The cut of fuelwood is declining more rapidly than that of any other commodity. Since 1900 it has dropped from 14.3 billion cubic feet to 5 billion cubic feet in 1930. This ratio is 2.86 which coincides closely with the figure 2.88 for the ratio of per capita consumption in 1900 to that in 1930.

4. The use of sawtimber for fuel has declined from over 50 billion feet b.m. in 1890 to about 5 billion feet in 1930.

5. The use of wood for pulp accounts for less than 1 per cent of the total cut.

A few of the conclusions may be set down as follows:

1. We have perhaps grossly underestimated the original stand of timber and likewise the original productivity of our forest areas. We are probably also underestimating the productive capacity of these forest areas for the future.

2. Apart from the intentional destruction of standing timber to make way for agriculture the use of wood for fuel has accounted for possibly half of the heavy drain upon our forest resource.

3. With the reduction of the use of wood for fuel there is a reasonable prospect of a balanced timber budget for the country in the not distant future.

4. The drop in total per capita consumption of wood is not so much a matter of declining serviceability of wood for

general purposes as of its displacement by coal, oil and waterpower in its least important use, i. e., as fuel.

5. The use of wood in this country is likely to be on a much higher plane of values in the future than in the past. This should mean higher stumpage values for quality products and greater incentives for continuous production under sound plans of management.

6. The important chapters in the history of the use of wood pulp in this country are still to be written.

Thirty-Five Years Ago

Did You Know Them Then?

The opportunity offered by the Division of Forestry of the Department of Agriculture, for field instruction during the present summer, met with an immediate response from a large number of young men, many of them college undergraduates, who were desirous of becoming student-assistants. The great excess of applications made a careful examination and selection necessary, with the result that the following young men have been chosen to work under the direction of these officials:

With Gifford Pinchot, Forester of the Department of Agriculture, working in the State of Washington: Stuart Hotchkiss, Richard Thornton Fisher, E. J. S. Moore, E. Koch, J. Frazier-Curtis, William M. Maule, Thomas C. Carson, Kinsley Twining, Jr., William B. Hodge, Jr., Henry James, 2d., William James, Jr., Frank A. Spragg, E. T. Allen and William F. Wight.

With Henry S. Graves, Assistant Forester of the Department, working in the Adirondacks: Smith Riley, Henry Grinnell, Fred Nash, Oscar S. Pulman, Jr., Edward T. Grandlienard, M. DeTurk High, John Victor Doniphan, Jr., Charles Jones, Edwin Colby Lewis and William P. Haines.

With W. W. Ashe, Forest Expert of the Division of Forestry, in North Carolina: A. E. Ames, A. E. Cohoon, J. A. Caldwell, Jr., and H. McC. Curran.

In the office of the Division of Forestry at Washington: Treadwell Cleveland, Jr.—From *The Forester* (1899).

POSSIBLE PUBLIC FOREST ACQUISITION PROGRAM FOR TENNESSEE

By JAMES A. HAZARD

State Forester, Nashville, Tennessee

Herewith is State Forester Hazard's outline of two possible courses of action for public forest acquisition in Tennessee. His comparison of their respective merits is of no little interest and value in the current active interchange of ideas concerning state forestry and ways and means for developing it to its proper place in the general scheme of things.

THE State of Tennessee cannot be expected to finance the purchase of state forests to any great extent because of existing heavy indebtedness. If federal activities were to cease there would be very good prospects for acquiring state forests by donation of surface rights on cut-over properties held chiefly for mineral. Several such prospects had nearly materialized when a federal announcement that $20,000,000 was available for forest purchase, partly in Tennessee, was published in the late spring or early summer of 1933. This naturally greatly decreased the chance of donations. These present conditions point to federal purchases as the most reasonable expection.

Two seemingly practical possibilities present themselves as follows:

A. A purely federal program in keeping with the present national program and consisting of the acquisition of approximately six million acres in the forested regions of the Cumberlands and the Highland Rim section along the Tennessee River in West Tennessee. This would be a purely federal undertaking in purchase and administration. Such acquisition would require the approval of the Governor of Tennessee under the present laws.

B. A coöperative federal-state program based on the present Tennessee program as to location of forests and designed to serve both federal and state objectives. It would consist of an original purchase of approximately one million acres in 10,000 acre tracts, to be thought of as forestry "Service Station Forests," located strategically, checkerboarding the state approximately twenty miles apart, center to center. They might be purchased with federal funds and leased to the state for administration under strict federal supervision until such time as the state could assume entire and competent responsibility for handling these forest so as to serve fully both federal and state purposes. Under this plan each original 10,000 acre forest would be the center of a potential "acquisition" area of 250,000 acres—the "Service" area of the forest—within which any land not suited to private ownership could be acquired easily and administered economically. Practically all the land in the state would become subject to close scrutiny, classification, and adjustment of ownership between public and private interest, under this plan.

The above statements are intended merely to outline the most feasible possibilities. It seems well to picture the needs for public forest acquisition in Tennessee and to discuss the relative merits of the above proposals in the light of such needs. I will try to accomplish this as briefly as possible by indicating the needs and referring to the two proposals as A and B respectively.

Forest Fire Control.—A could be ex-

pected to provide adequate fire control on the area acquired, i. e., up to six million acres not now in public forests.

B could be expected to provide adequate fire control on the 13,500,000 acres not now in public forests and extend that benefit to perhaps three million acres of submarginal farm land that may be expected to revert to forest in the natural course of events.

Forest Improvement.—A would have little influence outside of the approximately six million acres federally owned.

B should provide encouragement and direction to all private forest owners in the state affecting directly up to sixteen or seventeen million acres of forest and waste land.

Timber Market Development and Maintenance.—A would furnish raw material for industry in and near the concentrated national forest areas but would be of comparatively little assistance in establishing and maintaining markets for private forest owners at a distance from the national forests whose lands would total from eight to ten million acres.

B would tend to develop regular supplies of raw material for local industries throughout the entire state, and to encourage private owners in adopting the same sustained yield practices on their forests that would be demonstrated constantly on the coöperative federal-state forests. Good management on all private lands should naturally result without government regulation which might be the alternative if the general public welfare is to be protected. Permanent state wide markets for the forest products from private forest lands should result.

Reforestation of Waste Open Lands.—A would probably be concerned only with such lands as were actually acquired for national forests.

B could provide conveniently for the restocking, not only of lands acquired for forests, but for all private lands within the state by the enlargement of the present program under the Clarke-McNary Law.

Wildlife Restoration.—A should provide for satisfactory wildlife restoration on approximately six million acres of national forest lands thus acquired and on private land in their immediate vicinities.

B could provide wildlife restoration not only on the coöperative federal-state forests, but should rather quickly replenish that on the additional 25,000,000 acres of private farm and forest lands [in addition to permanent game refuges on each such forests, game-nurseries (or farms) could be maintained and stock distributed to coöperating landowners from each local forest in the same way that tree seedlings are now distributed under the Clarke-McNary Law expectation].

Forest Recreation.—A would provide forest recreation to those able to travel long distance but could do little for the balance of the population.

B would place forest recreation at the disposal of practically every citizen of the state, since theoretically at least a coöperative federal-state forest would be within from eight to ten miles of every citizen's home.

Stream Flow Regulation.—A would control the streamflow on about six million acres.

B should control it on one million, and influence it favorably on from 13,500,000 to 16,000,000 acres of forest land and on from nine to twelve million acres of field and pasture.

Soil Erosion Control.—A would directly improve soil erosion control on about six million acres.

B would directly improve soil erosion control on 1,000,000 acres and indirectly on 25,000,000 additional acres.

Acquisition and Administration of Forest and Submarginal Farm Lands.—A would be limited to about six million acres.

B would be limited only by the extent of the lands in the state that should be taken out of private use and placed in public forests.

Social and Economic Influences. — A would probably tend to stifle private enterprise within the acquisition areas. It would make national forest business the dominating influence in the areas affected. Until timber yields are reestablished those in and near the federal areas would probably find private business greatly reduced. This might result in depopulating certain sections which could otherwise continue until reestablished timber production would help provide them with satisfactory living conditions. The national policy of "blocking up" forest areas for administrative reasons, while desirable in the unpopulated and inaccessible regions of the West, would prove very undesirable in the fairly accessible forest regions of Tennessee, if it resulted in removing from the land those who, with some local employment on public forests, could retain their homes and provide properly for their families. This program might in some cases destroy local county government by eliminating tax returns. While it is granted that we seem to have too many counties in Tennessee it seems desirable to have local government wherever suitable land is available for a satisfactory agricultural economy. Most counties possess such lands in sufficient quantity to justify a reasonable local government.

B should encourage private enterprise by relieving landowners throughout the state of lands unsuited to private ownership and because of its flexibility of application would encourage sub-marginal farmers to become "subsistence homesteaders" on their own land by offering part time employment in connection with the care and development of these public forests. This should prove a great aid to the "subsistence homesteader" movement. There should be opportunities to give such employment on both the central "Service Stations" Forests and the outlying supplementary public forest areas. Under this program no drastic changes in local tax returns should be realized so that local governments would not be seriously embarrassed by public ownership. It would provide for a conservative gradual adjustment between public and private forest ownerships. Widespread government ownership of lands unsuited to private ownership would relieve private enterprise from a heavy burden and should prove a boon socially and economically.

Natural Resource Conservation.—A, by means of a six million acre purchase, should provide for excellent conservation on the said six million acres.

B, by means of one million acres original purchase, would initiate conservation service on the entire twenty-six million acres now privately owned. The returns on the public investment would seem to far outweight the results that might be achieved through A. Also private ownership of forests might become attractive as a result of such conservation service. The possible accomplishment of B, on the basis of a one-acre purchase out of twenty-six seem more worthwhile than that of A on the basis of a six-acre purchase out of twenty-six.

Continuance of the C.C.C.—A would tend to concentrate C.C.C. camps in the more remote forested sections where the benefits to the general public would probably be less than would be the case if the public forests were more widely disseminated.

B would provide employment for widely disseminated C.C.C. camps from which benefits to the public would be widely re-

alized which should foster their continuance.

A Plan for Permanent Conservation Work to Replace the Emergency Conservation Work

In my opinion the following steps are entirely feasible and should provide unemployment relief and essential conservation service:

1. Place the forestry camps entirely under the direction of the U. S. Forest Service.

2. Purchase approximately 10,000-acre forest or sub-marginal farmland areas about 20 miles apart to be developed as permanent "Conservation Service Station" State Forests, i. e., in addition to the usual state forest development, conservation work similar to that being done by the C.C.C. would be carried on in the conveniently adjacent territory.

3. Have each such state forest service an area approximately 20 miles square by means of a permanent C.C.C. personnel.

4. Select the boys from the local areas if possible so that the information gained can be applied at home in similar surroundings. From 50 to 100 boys per camp should prove a more satisfactory unit than a greater number, but more or less could be employed to meet temporary social and economic needs.

5. The boys employed on each forest should clear land, if necessary, and "subsist" themselves to relieve the Government of this cost, and to give those in charge an opportunity to teach efficient subsistence homesteading. This would enable them, after a year's enrollment, to undertake homesteading in groups or individually, with a reasonable prospect of success. Qualified supervision would need to be employed at first to teach the elements of successful homesteading, but it is probable that boys could be selected at the end of a year's training who would be qualified to carry on this teaching, thus making it self perpetuating.

6. In addition to improving each such state forest for forestry purposes, the following conservation services should be applied throughout each area served:

1. Forest fire control
2. Forest improvement
3. Timber market development and maintenance
4. Reforestation of cutover and waste land
5. Wildlife restoration
6. Forest recreation
7. Stream flow regulation
8. Soil erosion control
9. Acquisition and administration of "submarginal" lands within the "Service" area.

This plan would provide widespread conservation service, immediately, regardless of land ownership and might make private forestry more attractive than it has thus far appeared.

EFFECTIVE EXTENSION PROCEDURE FOR THE CONSERVATIVE CUTTING OF PULPWOOD ON SMALL WOODLAND AREAS

By ROBERT MOORE

Formerly Extension Forester, Louisiana State University

Perhaps the methods of reaching the farmer now in use by extension foresters and largely carried over from those used by agriculturists are not adapted to the forest crop and to the farm forest problem. A new method of attacking the problem is here discussed. It consists of first securing the coöperation of the buyers of forest products by pointing out to them that it is in their own interest to have farmers practice forestry. The advantages of using forestry principles in timber cutting are pointed out to both business men and farmers and finally the enforcement problem is handed over to the timber buyers for they alone can apply the most powerful of all influences, economic pressure. The presentation is based on an actual use of the method in pulpwood cutting and not on theoretical considerations. The author does not claim that any single part of the method is original. He does hope that this may influence others to attempt the development and use of new methods in forest extension.

IF there is any need for an examination of our methods of handling our extension forestry projects this is the time to make that examination. The dislocation of all extension activities, particularly those of an educational nature, due to the A. A. A. program and the growing disposition to add regulatory work to the extension program seems to give us an unusually fine opportunity to examine our forestry projects and see whether or not we could revise our program in an effort to strengthen and improve it.

It has seemed to some foresters that extension work in forestry is not as successful as it should be. This is probably true, but we must remember that forestry is a new thing when compared to most of the projects making up the extension program and has so little of the impetus that carries many lines of work. Due weight must be given the fact that the county agents hesitate to tackle a problem so complex as the forest problem with as little knowledge of forestry as most of them have. Indeed, this point was raised in the Copeland Report and was discussed as one of the weaknesses of the extension forestry program. The extension forester must spend much valuable time teaching county agents things they should have learned during the regular agricultural course which all of them have taken. Since this situation exists and has been recognized it would probably be well to give some attention to it in considering any probable changes in the procedure which may be developed as a means of improving extension work in forestry.

Perhaps a statistical summary of extension work in forestry will substantiate this apparent failure. For instance, let us take the best data on extension activities that can be secured. From U. S. D. A. Extension Circular 187, "Statistical Results of Coöperative Extension Work, 1932" we get the following figures on farm forest extension work in the United States during that year.

Adult result demonstrations	6,855
Farms assisted in management	8,223
Farms assisted in other ways	8,195
	23,273

If every one of these demonstrations reported is a management demonstration, and better farm woods management is

what we are trying to teach, forestry is reaching only 23,273 farms out of the 6,288,648 farms in the United States.

The weaknesses of annual reports are well known. If we assume that not more than 50 per cent of the farms actually reached are reported by county agents we still have a terrifically large field which is not being touched in any except a very general way. This is so even if we take into consideration the fact that coverage can never be 100 per cent effective. If this shows our present plan of action is inadequate, and it seems to do just that, what is the solution? Perhaps new points and methods of approach which promise better results can be found.

The easiest point at which to attack any problem is the place where the elements in the problem are concentrated and can be handled without having to solve each one separately. This is not a new concept. It has been recognized and acted upon by many persons in the business world and its value has been pointed out by many of our leading economists. It is the idea behind the original Standard Oil Trust, and most of our major industrial combinations have been built on this principle. Naturally it has been applied primarily for price control but in the case of the original Standard Oil Company an effort was made to correct a chaotic condition in the producing field as well. This is just the condition we hope to correct on the farm woodlands.

The point then at which we can most easily attack the farm forestry problem is where the raw material concentrates; at the mill where the raw material producer or farmer in this case, sells his product. We believe the Louisiana situation cannot be handled in any other way. This is not hard to prove. We have six pulp and paper mills in the state. Estimates by the land and timber agent of one pulp and paper company based on a five-year record shows the average supplier of pulpwood cuts from twenty (20) acres of land with an average yield of five cords per acre. In 1933, this company alone bought 188,081 cords of wood. Thus more than 37,616 acres of woodland were cut over to supply one mill. More than 1880 farms contributed pulpwood to keep the wheels of this one mill in operation. For the entire state using the same estimate of 5 cords per acre and 20 acres per farm as a basis and figuring from the actual purchases of pulpwood by Louisiana mills, more than 106,925 acres of farm timberland on 5,346 farms were cut over in 1933 to supply this single Louisiana industry with raw material. This is more than one-fifth of all the farms in the United States reached by the forestry program.

This problem of pulpwood cutting is not distributed among all the sixty Louisiana county agents, but it is handed to sixteen with the principal burden on not more than ten of them. If the county agents are to handle the volume of work that this one industry demands they will do an amount of work on the forestry project that will be many many times that done in the past. Obviously this is an impossiblity considering the men available and the demands on them. The mere physical volume of the work demanded makes it impossible of accomplishment for this pace must be maintained year after year as new farms must be drawn on annually to supply this pulpwood. The cutting method in use at this time removes all trees down to and including the five inch d.b.h. class. Thus no second cutting can be made for many years and the mill must always seek new sources of supply.

It is worth while to again mention that these figures cover the pulp and

paper industry only. They do not include the trade in saw logs, ties, posts and poles, fuelwood, handle stock, hoop stock, stave bolts, shingle bolts, and the many other items that go to make up the farm timber trade. One paper mill, for example, in 1933 purchased more fuelwood than it purchased pulpwood.

The standard extension methods offer us little help on this problem. Indeed, they only emphasize the need for new techniques. For each change brought about by a result demonstration it costs $10.08. If we need to influence only 3,000 farms per annum a budget of $30,000 for forestry in only ten counties is indicated. If we are to use exhibits a budget of $78,900 is indicated. Of course, the latter method would be used only in combination with other methods but the figure serves to emphasize the impossibility of any solution by ordinary methods.

We can go further and examine this problem from a different angle. How many farmers would we actually have to contact in order to influence the 5,346 we must influence? Roughly, twice as many must be reached as we hope to influence. This is conservative. Using one extension method, 40 times as many must be reached as are influenced. This at least doubles our figures all the way down the line and as we said at the start, puts the problem quite beyond the reach of any ordinary extension method.

The sole discernible avenue of attack was through the men who make the actual purchases of pulpwood for the mills. The first part of the problem was to convince each of these men that it would be to the advantage of his mill to demand that forestry principles be used on all pulpwood cuttings on private timber lands that are tributary to the mill. This is not an easy task, but it can be and has been done. The method used will be briefly described for we believe it can be used by others.

The mill's purchases of pulpwood during the period since its establishment were reduced to an acre basis at five cords per acre. This indicated the rate at which the available pulpwood supply was being exhausted. The next step was to estimate the size of the remaining supply of pulpwood that could be drawn on by the mill. The approximate limits of pulpwood supply by both rail and truck haul were determined. The former is based on freight rates and the latter on highway conditions. Twenty to twenty-five miles seems to be the limit for truck hauls. Indeed, twenty miles is almost the longest haul that can be made and leave any margin for stumpage. Hauling is done entirely by contract haulers and not by the farmer or stumpage owner. Eight miles seems to be the limit for truck hauls if the principle haul is by rail. The report of the Louisiana Tax Commission gives the acreage of timber land in each parish. Allowance was made for lands not available by reason of their location and once more using the same figure of five cords per acre as a converting factor a pulpwood supply estimate was prepared.

Frankly, it was an estimate and a rough one. Knowledge of field conditions entered very largely into the calculations. No extension forester who has been on the job for any length of time can fail to pick up discrepancies as they develop. When an estimate got out of line, it was immediately revised based on the judgment of the estimator if nothing better was available. The figures were then used in a selling talk to the timber agent or paper mill manager.

The solution of the problem is dependent to a great extent on the choice of the man with whom the problem is

discussed. In one case efforts made through the land and timber agent were always successful; in another the approaches had to be made through the manager. Every effort to put over any work in connection with the second mill has failed when the discussion was with land and timber agent, while at the first mill it has been uniformly successful. Friendly relations must be established in advance and a certain degree of mutual confidence must be built up. The whole problem can then be defined and the advantages of some sort of cutting regulations pointed out. We did not present the estimate as such but worked it out with the agent. The original estimate may not be recognizable in the final result but this will not be a disadvantage. Quite the contrary. By making his own estimate the agent convinces himself of the importance of the problem confronting him.

The problem recognized a solution is next and it is almost obvious. Some clauses must be inserted in the mill's purchase contracts that will assure the leaving of an adequate growing stock and so give a second cut in the not too distant future. We requested these cutting rules from the Southern Forest Experiment Station. When received, they were extremely practical and what is more important they were supported by financial calculations which could be adapted for use before groups of farmers. The rules were submitted to the paper mill authorities and gone over with them. We simplified and condensed the rules to make their application easier. Incidentally the modification also made the inspection of the area after cutting easier and gave less room for disputes over the inspection. The rules are as follows:

Cutting Instructions

FOR LOBLOLLY-SHORTLEAF PINE LANDS IN TERRITORY TRIBUTARY TO THE MILL OF THE BROWN PAPER MILL CO.

General Rules.

Leave one pine seed tree 11 inches stump diameter[1] or larger on each quarter acre.

Trees should be selected for seed production. This means large crowns and/or abundant old cones. Loblolly pine (*Pinus taeda*) should be favored for these seed trees.

Supplementary rules for different kinds of stands.

1. *Irregular stands with a wide range of intermingled diameter classes and uneven crown canopy.*[2]

In the diameter class from 7-10 inches stump diameter (inclusive) leave trees of this class so they will be not more than 18 feet apart or not less than 34 trees of this class per quarter acre.

2. *Stands in which a narrow range of diameter classes predominates and the crown canopy is relatively even as in even aged old field stands.*

a. In stands averaging 12 inches stump diameter or more, leave all trees below 10 inches stump diameter.

b. In stands averaging 9 inches stump diameter, leave at least 34 7-11 inch trees per quarter acre spaced not more than 17 feet apart.

c. In stands averaging 6 inches stump diameter or less, no cutting should be made.

[1]Stump diameter:—This is the diameter on a stump 8″ high.

[2]Crown canopy—The "cover" formed by the tops or crowns of the trees. This may be even as in trees of practically the same height or uneven when the trees vary in height.

The next step was a discussion of these rules with the pulpwood contractors who are divided into two classes by the mills. The first class is composed of contractors who have an annual contract to supply a definite monthly allotment which in practice is a minimum figure rather than both a minimum and maximum. The second class contains those who get a contract to supply from ten to fifty cords or even more. These men usually get one or two contracts a year always during good weather when expenses will be at a minimum. To reach any of these contractors is a real problem, but to reach the members of this latter group is almost an impossibility unless the active assistance of the pulpmill people is received. The first class of contractors is usually composed of farmers who make a good portion of their living from supplying the pulpwood requirements of the paper mill rather than from the farms they own. A meeting to explain the rules was arranged at the mill which was attended by some 35 of these principal contractors. None of the principal contractors opposed the move and practically all of them admitted it was a necessity.

The basis for the discussion at the meeting was a series of charts, similar to Figures 1 and 2. They were made up in wall size, but only one method of cutting and one set of financial calculations was shown on each chart instead of the composite or comparative charts. This materially simplifies the charts and makes their discussion more easily understood. In all financial calculations compound interest was computed at 4 per cent per annum and stumpage values of fifty cents per cord were used.

Chart I is based on a study of more than 300,000 acres of pine land in Union Parish, Louisiana and shows the volume of pulpwood secured from an acre of forest containing 5.4 cords of pulpwood. The cutting methods compared are the usual practices and those recommended by the Southern Forest Experiment Station and embodied in the rules. While the first cut under the rules produces less wood, the second cut produces three times as much as could be cut under ordinary

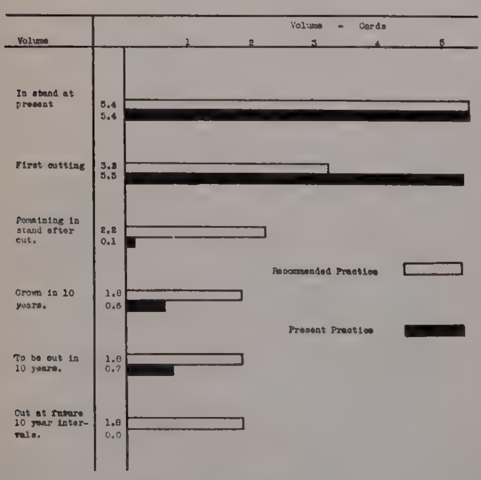

Fig. 1.—Stand No. 1. Results of two methods of cutting

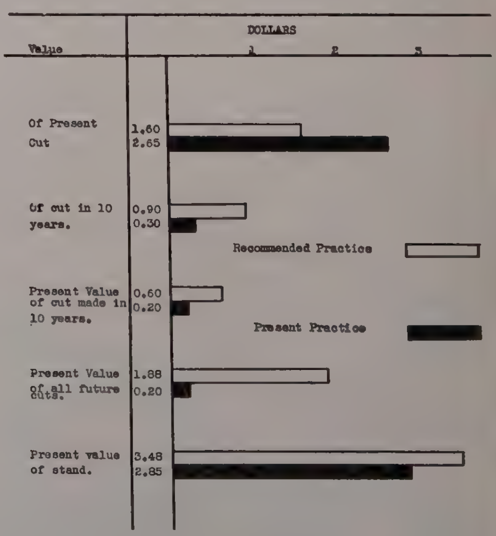

Fig. 2.—Stand No. 1. Cash income from two methods of cutting

practice. Cuts can be continued indefinitely under the rules while under the present practice the stand will be devastated after the second cut. Indeed, it is doubtful if a second cut could be made.

Chart 2 shows financial calculations based on Chart 1. It shows an immediate monetary advantage in favor of the destructive cutting method now followed but it also shows an ultimate advantage in favor of the better and more conservative cutting methods.

A question period has been allowed after each presentation of the charts and many of these periods have been lively ones. The most difficult point to explain has been the discounting of the recurring future values. This has been done satisfactorily by comparing it to rent with which all farmers are familiar.

A series of meetings was held over the entire producing territory to reach contractors of the second group and explain to them the background of the move and its advantages. We made a special effort to get the support of bankers, merchants, and parish officials. With these ends in view the county agents made arrangements for not only the regular and usual parish-wide meetings, but also for talks at Rotary, Lions and Kiwanis Clubs. We feel that the support of these men is particularly valuable for the program does reduce the immediate cash revenues of the farmers. We have approached these men entirely from the financial standpoint showing them the possibilities of a permanent industry at some sacrifice of immediate returns. The same method has been used in talking to the farmers. They can appreciate the financial appeal and rather surprisingly do not seem to object to the prospect of a somewhat lower immediate income. This is not as peculiar as one might expect. The present drive for forestry seems to have helped us in this respect.

The rules were made a part of all short term contracts after October 1, 1933. Annual contracts were signed January 1, 1934, and these too contain the cutting rules. All contracts are immediately cancellable for violation.

The matter of inspection remains. The rules will not be effective unless some inspection is made. We must do this through and with the county agent. The mill has offered to place two men at our disposal on a part-time basis. This will do a great deal to solve our inspection problem. Circumstances have been such that we were not able to organize this inspection work immediately after the rules were made effective. It is being organized at the time of writing and is bringing up problems as interesting as any we have previously confronted.

The plan is not experimental. The reception has been encouraging. We have requests from two mills to discuss this plan with them and will do so when the time is ripe. We believe this to be the proper way to handle the problem of getting forestry into practice on the woodlands of the farmer.

SUSCEPTIBILITY OF PRINCIPAL RIBES[1] OF SOUTHERN OREGON TO WHITE-PINE BLISTER RUST

By J. W. Kimmey[2]

Bureau of Plant Industry, Portland, Oregon

Effective planning of the control of the white-pine blister rust in the sugar pine forests of southern Oregon requires a knowledge of the susceptibility to the rust and capacity to produce pine-infecting spores of the ribes of that region, ribes being the alternate hosts of the causal fungus. To secure this information, over 300 plants of the principal ribes of southern Oregon (8 species, one of which has 2 varieties) were placed in an experimental garden on the Mt. Hood National Forest where they were tested under heavy rust-infection conditions. Results of the tests, conducted over a period of three years, show that all these species are congenial hosts for the rust and should be eradicated as a protective measure in those areas where it is desired to maintain sugar pine forests.

The rapid spread of the white-pine blister rust (*Cronartium ribicola* Fischer) into northern and central Oregon (5, p. 687) has necessitated obtaining a knowledge of the reaction of the fungus on the important ribes in the valuable sugar pine (*Pinus lambertiana* Douglas) stands of southern Oregon for use in planning the application of control measures in that region. To obtain this knowledge inoculation tests were made to determine the relative susceptibility to the rust of hitherto untested ribes species of southern Oregon. This paper presents the results of these inoculation tests, together with a comparison of the susceptibility of the ribes species of southern Oregon with that of the red-flowering currant (*Ribes sanguineum* Pursh.), a species of definitely established susceptibility (1; 2, p. 882; 7, p. 20).[3]

Species Tested

In 1930, rooted plants of nine kinds of ribes (Table 1) were placed in an experimental garden near Rhododendron, Oregon. The test plants were collected in the regions and under growth conditions as shown in Table 1.

Establishment of Experimental Plot

To avoid introducing the rust into a region previously free from it, inoculation experiments were carried on in an area within the range of the disease. The most satisfactory location ecologically and accessibly was near Rhododendron, Oregon, on the Mt. Hood National Forest, where heavy infections on pines (*Pinus monticola* Doug.) had already been found. In early October, 1930, over 300 young plants of the eight ribes species of southern Oregon were planted in a specially prepared garden at this location. The plot site was selected to fulfill, as nearly as possible, the ecological requirements of the different species. The desert gooseberry was planted

[1]The common noun ribes is used in this paper to include both currants and gooseberries.

[2]The writer is indebted to L. N. Goodding of the Division of Blister Rust Control for the collection of the ribes and the establishment of the garden; and to H. G. Lachmund, J. L. Mielke, T. W. Childs, and T. S. Buchanan, of the Division of Forest Pathology, for assistance in the studies described in this paper.

[3]The unpublished results of other tests of the susceptibility of *R. sanguineum* (conducted by the Portland office, Division of Forest Pathology, near Rhododendron, Oregon, where the present study was carried on) show a degree of susceptibility similar to that reported in published data.

in an open and extremely dry place, while the other species were planted under partial shade. The transplants were allowed nearly 20 months to become established before they were artificially inoculated in the spring of 1932. Although natural infection was present in 1931, it was not severe enough to weaken the plants in any appreciable degree.

Twenty-five red-flowering currants, native in the immediate vicinity of the garden, were included in the study to allow for the proper evaluation of the degree of infection on the planted species. The native plants chosen were considerably older and larger than the southern Oregon plants, and some of them were nearing over-maturity. Observations made over a number of years by members of the Division of Forest Pathology, Portland, on the susceptibility of western ribes have indicated that plants may acquire a certain degree of resistance as they reach the over-mature stage. In the present case the plants seemed to be somewhat below average in susceptibility. This fact should be considered when comparing the susceptibility of this species with those of the ribes of southern Oregon.

Inoculation and Examination[4]

In May 1932, at the time when the young ribes leaves were most susceptible to infection (3, 4), each plant was inoc-

Table 1

TEST PLANTS

Species	Region	Growth conditions
Klamath gooseberry *G. klamathensis* Coville	Klamath Lake shore	shoreline
Klamath gooseberry *G. klamathensis* Coville	Prospect	along streams shaded by willows
Applegate gooseberry *G. marshallii* (Greene) Coville & Britton	Oregon Caves region	altitude 6,000 feet; open pine woods on sites very wet in spring; very dry in late season
Red-flowering currant (Oregon Caves form) *R. sanguineum*[1]	Oregon Caves region	steep slopes immediately above caves in quite open sites
Sticky currant *R. hallii* Janez.	Union Creek, Crater National Forest	open, rocky ridges
Siskiyou gooseberry *G. binominata* (Heller) Coville & Britton	Siskiyou Mountains	steep slopes with shifting soil
Crater Lake currant *R. erythrocarpum* Coville & Leiberg	Crater National Park	forms carpets beneath mountain hemlock and white-bark pine
Desert gooseberry *G. velutina* (Greene) Coville & Britton	Klamath Lake	open, rocky slopes in very dry sites above Klamath Lake
Shiny-leaved gooseberry *G. cruenta* (Greene) Coville & Britton	Prospect	open slopes and ridges above Rogue River, south of Prospect

[1]This is the southern Oregon form and is not typical of *R. sanguineum* Pursh., according to L. N. Goodding. It has been called the Oregon Caves form of *R. sanguineum* only because no other name is available. Little is known of this plant, and it is considered in this paper as a separate species.

[4]The methods described in this section were devised in 1924 and 1925 by H. G. Lachmund, who initiated the present study. They have been used with consistent success in many of his large-scale studies of the susceptibility of western ribes species to blister rust (2, 3). See also reference in footnote 6.

ulated with aeciospores taken from cankers of western white pine in the vicinity of Rhododendron. The method employed was simple and effective, i.e., fruiting cankers were placed in heavy paper bags which were used in bellows fashion to shower the leaves with spores. A heavy rain following the inoculation provided ample moisture for the germination of the aeciospores. Examinations were made at approximately monthly intervals from the time of inoculation until mid-September when the plants were approaching complete defoliation. At each examination the number of infected leaves on each plant was recorded, and estimates were made of percentage of infected surface on infected leaves, and percentages of infected surface bearing telia, bearing uredinia, dead before the production of telia, and lost through defoliation before the production of telia. A complete record of infection for each individual bush was thus secured.

In 1931 and 1933 the plants were not artificially inoculated but were exposed throughout the aecial sporulation period to aeciospores from fruiting cankers on infected pines in the vicinity of the garden. During these two seasons the ribes were examined periodically.

Results

A summary of infection data at the time of the last examination for each of the ten groups of plants for the year 1932 is given in Table 2, in which the ribes of southern Oregon are arranged in order of their susceptibility under the native *R. sanguineum* group so as to simplify the comparison of susceptibility. Moisture conditions during this year were exceptionally favorable for rust development and the resulting infection was therefore somewhat heavier on all ribes than would normally have been the case under average weather conditions.

Ribes sanguineum has been classified by Lachmund (1, 2, 3) as particularly susceptible and moderately high in the production of telia. The amount of infection produced on these native test plants, however, was somewhat less than the average infection normally found on younger and more succulent plants, and direct comparison with the infection secured on the ribes species of southern Oregon is difficult. Lachmund's conclusions, however, are verified in Table 2 if the resistance of these older native plants is considered.

In comparison with *R. sanguineum*, the data in Table 2 show that all the southern Oregon species are highly susceptible, except *R. hallii*, which is comparatively low in percentage of total leaf surface infected, and they may all be classified as either moderate or high in the production of telia. In order of total leaf surface bearing telia, those high in the production of telia are: *G. marshallii*, *G. klamathensis* (Klamath Lake variety), *G. cruenta*, *G. binominata*, *G. klamathensis* (Prospect variety), and *R. erythrocarpum*. Those moderate in the production of telia are: *R. hallii*, *R. sanguineum* (Oregon Caves form), and *G. velutina*. Referring to the data secured in 1932 on *G. velutina*, it should be stated that precocious defoliation of the test plants caused by the heavy infection of the rust appeared largely responsible for the low percentage of total leaf surface bearing telia. By June 29, 50 per cent of the leaves had fallen from the plants, causing 60 per cent of the infected leaf surface to be dropped before telia could be developed. By August 3, the plants were 88 per cent defoliated. At the time of the final examination on September 3, 82 per cent of the infected leaf surface had dropped before telia could be developed and the remaining 1 per cent of the leaves bore abundant telia, indicating

the potentiality of good telial production under lighter infection conditions. This fact was borne out in 1933 under the lighter infection conditions caused by the natural aecial inoculation. At the final examination of that year on October 5, 88 per cent of the infected surface had produced telia, and only 2 per cent of the infected surface had been dropped by defoliation before telia could be produced.

In 1933 the infection on all other species produced approximately the same percentage of telia as in 1932 under the heavier rust-infection conditions.

The fact that all of the species tested became infected in both 1931 and 1933 under natural aecial inoculations, together with the results of the artificial inoculation in 1932, would seem to indicate that all species except one could be classified as highly susceptible to the rust, using as a basis of comparison the amount of infection secured in similar tests on the wild black currant (*R. petiolare Doug.*)[5] and the Sierra gooseberry (*G. roezli* (Reg.) Cov. & Brit.) (6, p. 32). The one exception here referred to was *R. hallii,* which became somewhat more lightly infected.

If the results of this three-year test are considered as indicative of the behavior of the rust on these species, any effective control of the disease on the sugar pine areas in southern Oregon will necessarily call for eradication of all of the species tested that may be present on such areas.

Summary

In the formulation of any sound control program to protect the valuable stands of sugar pine in southern Oregon from blister rust, information concerning the ability of the important ribes of that region to harbor and spread the disease is essential. To secure this in-

Table 2

SUMMARY OF INFECTION DATA FROM THE 1932 ARTIFICIAL INOCULATION

Species and variety	Plants[1] tested	Percentage of leaves infected on infected plants	Percentage of leaf surface infected on infected leaves	Percentage of total leaf surface infected	Percentage of total leaf surface bearing telia
R. sanguineum (native)	25	82.5	39.6	32.7	23.4
G. klamathensis (Klamath Lake)	11	99.0	93.7	92.8	67.4
G. marshallii	57	97.9	93.9	91.9	68.9
G. cruenta	39	98.8	87.7	86.6	58.3
G. binominata	60	100.0	84.7	84.7	47.1
R. sanguineum[2] (Oregon Caves)	19	100.0	81.3	81.3	20.3
G. klamathensis (Prospect)	7	97.4	79.2	77.1	42.4
G. velutina	24	96.8	66.4	64.3	19.3
R. erythrocarpum	47	100.0	61.4	61.4	40.5
R. hallii	45	34.9	75.8	26.5	23.4

[1]All tested plants became infected.
[2]See footnote 4.

[5]Lachmund, H. G., Mielke, J. L., and Childs, T. W. 1934. "The Susceptibility to *Cronartium ribicola* of the Four Principal Ribes Species of the Commercial Grange of *Pinus monticola*." To be submitted for publication in Jour. of Agric. Research.

formation, in 1930 a large number of plants were transplanted in a garden near Rhododendron, Oregon, where the ecological conditions are similar to those where the plants were collected and where they might be tested under heavy rust-infection conditions. A study was conducted over a period of three years to determine the reaction of the rust on *G. velutina*, two varieties of *G. klamathensis*, *G. cruenta*, *G. marshallii*, *G. binominata*, *R. hallii*, *R. erythrocarpum*, and a form of *R. sanguineum*. All plants were subjected to natural aecial inoculations from 1931 to 1933, inclusive, and they were artificially inoculated in the spring of 1932 to assure an equal distribution of inoculum on all plants. Infection data were taken at regular intervals throughout the three seasons.

Data for these three years show that all of the ribes species of southern Oregon that were tested are high in susceptibility except *R. hallii*, which showed moderate susceptibility to infection. This species, however, produced telia on a large percentage of the infected leaf surface. All other species were high in the production of telia except the Oregon Caves form of *R. sanguineum*, which was moderate in this respect.

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STAND-BASAL AREA CURVES IN AMERICAN YIELD TABLES

By ELLERY FOSTER

U. S. Forest Service, Milwaukee, Wis.

It is observed that the relationships of stand-basal-area to average-stand-diameter in American yield tables are widely variable. As a result of this the question is raised whether or not the yield table procedure should be changed to make these relationships in the finished tables less variable and more true to nature.

ARE the numerous checks included in the standardized American yield table procedure sufficient to insure the finished tables against illogical and unnatural relationships? The writer recently had occasion to plot the figures for stand-basal-area over average-stand-diameter[1] from several American yield tables.[2] The relationships brought out by the resultant curves are so erratic that curiosity led to the plotting of similar figures from other yield tables, to a total of 20.[3] The wide variability of the relationships brought out, together with apparently unnatural tendencies in many instances, suggests a negative answer to the foregoing question.

What might logically be expected of curves of stand-basal-area over average-stand-diameter for normal, even-aged stands? Should they not (1) show a smooth and orderly variation of stand-basal-area with average diameter, and (2) a consistent and orderly relation, if any, of stand-basal-area to site quality?

In two of the twenty cases the curves of stand-basal-area over average-stand-diameter take a sharp upturn toward their outer ends (western white pine[4] Fig. 3, and red spruce-A, Fig. 4). Can this be a natural tendency?

Three of the sets of curves (Behre's ponderosa pine—Fig. 3, white fir—Fig. 2, and shortleaf pine—Fig. 1) flatten off after reaching a maximum. Is it not questionable, since in nature things seldom stand still, whether this is a natural tendency?

In the yield table studies, the relation of stand-basal-area to site quality is most variable, the variation in certain instances being the direct opposite of that in others. The types of variation can be grouped into three classes: (a) in which total-basal-area-per-acre is consistently higher on the good sites than on the poor sites; (b) in which total-basal-area-per-acre is consistently less on the good sites than on

[1] *Average stand diameter* and *average diameter* are used synonymously in this paper and refer to the diameter of the tree of average basal area.

[2] To the best of the writer's knowledge the use of average stand diameter as the independent variable in yield and stand table work comes to American forestry from Russia. Apparently it was first introduced into this country by Gevorkiantz (5) who used the curve of number-of-trees over average-stand-diameter as a basis for rejecting abnormal yield plots of eastern white pine. More recently Reineke (12) has employed graphs of number-of-trees-per-acre over average-diameter as the basis for developing a density index for even-aged forests.

[3] For the most part the figures plotted are for the total stand (1 or 2 inches and over d.b.h.). In two cases they are for the stand 3 and 4 inches and over (ponderosa pine in the Idaho region and white fir in California respectively). The omission of the smallest size classes makes very little difference in the shape of the curves except at the extreme left, and, therefore, the curves for the ponderosa pine and white fir are considered comparable to the others.

[4] For scientific names of all species mentioned see Table 1.

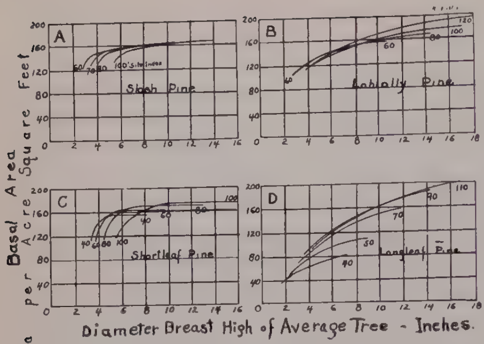

Fig. 1—Normal density curves from yield tables for four southern pines.

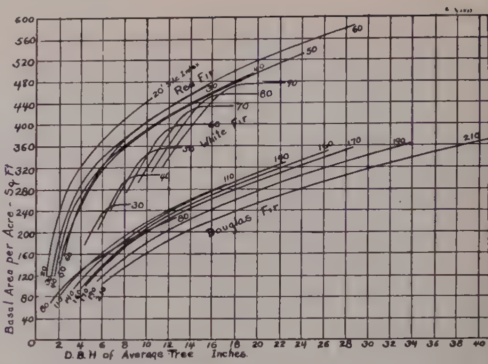

Fig. 2.—Normal density curves from yield tables for red and white fir (Schumacher) and Douglas fir (McArdle). Note the indicated relation of density to site quality. For Douglas fir the curves show greater density on poor sites than on good sites. The white fir curves behave in a very orderly but entirely different manner than the others. How much of the density-site relationships shown by these sets of curves is natural, how much attributable to imperfections in yield study technique?

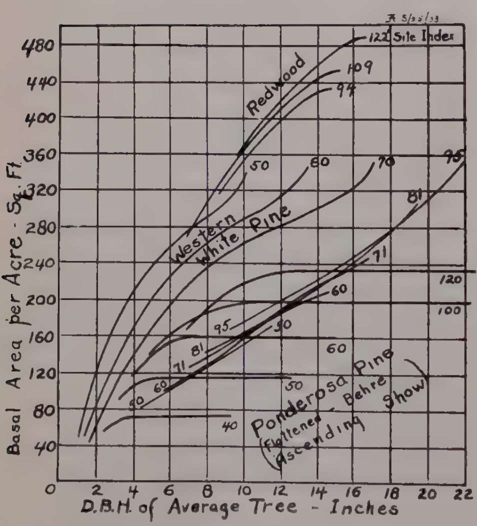

Fig. 3.—Normal density curves from yield tables for redwood (Bruce), western white pine (Haig), ponderosa pine (Behre, Show).

Redwood curves show the expected relation of density to site quality, good sites carrying heavier stands than poor sites.

The density-site relationship and the sharp upturn of the ends of the curves for white pine are considered unnatural.

The density of ponderosa pine in normal stands probably does not vary as much between the northern Idaho country (Behre's table) and northeastern California (Show) as the curves indicate.

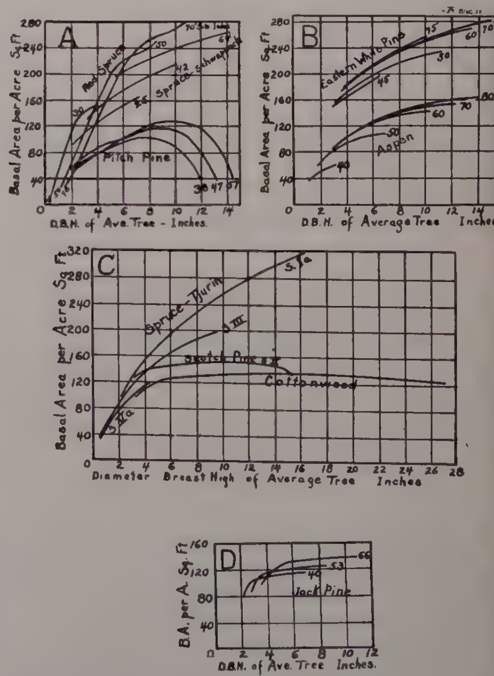

Fig. 4.—Normal density curves from yield tables for red spruce (Meyer) (A), Norway spruce (Schwappach) (A) (Tjurin) (C), pitch pine (Illick and Aughanbaugh) (A), eastern white pine (Gevorkiantz) (B), aspen (Kittredge and Gevorkiantz) (B), Scotch pine (Schwappach) (C), cottonwood (Williamson) (C), Jack pine (Wackerman) (D).

the poor; and (c) in which the relation of stand-basal-area to site quality is variable, the curves for the different sites crossing each other, etc.

Only 6 (and 2 of these are European) of the 20 yield tables studied fall in the first class (a). These are the redwood (Fig 3), pitch pine, eastern white pine, aspen and Schwappach's and Tjurin's spruce tables (Fig. 4). In the case of aspen there is a slight confusion of the curves for the best sites, but it is so slight that the table is put into this group rather than the third group (c).

Only one table falls in the second class (b) (western white pine—Fig. 3), Douglas fir (Fig. 2) would also fall in this class except for the curves for the poorest sites which cross the curves for the better sites and cause this table to be classed in the third group (c). The western white pine table shows a very consistent, if not radical, relation between site and density in terms of stand-basal-area.

Ten of the 20 tables fall in the third class (c). This class can be subdivided into two subclasses, one (1) in which the curves cross each other, and the other (2) in which the relation of stand-basal-area to site quality is even more disorderly than in the first subclass, and wherein the average site may have either a higher or lower basal-area-per-acre than either the best site or the poorest, etc.

Curves cross each other in the case of the yield tables for shortleaf, slash and loblolly pines (Fig. 1); white fir (Fig. 2); jack pine and red spruce (Fig. 4). All these tables show less basal-area-per-acre on good sites than on poor, for stands of small average diameter, and more basal-area-per-acre on good sites than on poor, for stands of larger average diameter.

The group showing the more disorderly relation of stand-basal-area to site quality includes longleaf pine (Fig. 1); red fir and Douglas fir (Fig. 2); and ponderosa pine (Fig. 3).

For the remaining two tables cottonwood and Scotch pine (Fig. 4), only one site quality is represented by the curves. These, along with the pitch pine table (Fig. 4), are tables in which stand-basal-area decreases after a certain maximum is reached. Is this the type of variation that might be expected of the other species given data far enough into the life of even-aged stands?

Most of the 20 yield tables used in this anaylsis were prepared according to the standardized American procedure. In view of the fact that many of them show apparently unnatural relationships between site quality and stand-basal-area for stands of equal average diameter, and in view of the erratic trend of the curves from two of the tables, are we not forced to question the degree of perfection of the accepted method of yield table preparation?

TABLE 1

SCIENTIFIC NAMES OF SPECIES MENTIONED

Common name	Scientific name[1]
Aspen	Populus Tremuloides Michaux
Cottonwood	P. deltoides virginiana (Castiglioni) Sudworth
Fir, Douglas	Pseudotsuga taxifolia (LaMarck) Britton
Fir, red	Abies magnifica A. Murray and A. magn, var. shastensis Lemmon
Fir, white	A conolor Lindley and Gordon
Pine	
Eastern white	Pinus strobus Linnaeus
Jack	P. banksiana Lambert
Loblolly	P. taeda Linnaeus
Longleaf	P. palustris Miller
Pitch	P. rigida Miller
Ponderosa	P. ponderosa. Lawson
Scotch	P. sylvestris
Shortleaf	P. echinata Miller
Slash	P. Caribaea Morelet
Western white	P. Monticola D. Don
Redwood	Sequoia sempervirens (Lambert) Endlicher.
Spruce, Norway	Picea excelsa Sink.
Spruce, red	P. rubra Link.

[1]According to Sudworth.

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[5] I wish to acknowledge the kind assistance of S. R. Gevorkiantz who aided me by translating essentail information in this publication, and advised in other ways. Thanks are also due R. M. Brown, R. K. Winters and D. M. Matthews all of whom gave constructive suggestions and criticism for the development of this study and reporting it.

LIFE OF DOUGLAS FIR SEED IN THE FOREST FLOOR

By LEO A. ISAAC

Pacific Northwest Forest Experiment Station

How long will Douglas fir seed remain viable in the soil or duff of the forest floor? The answer to this question is of vital importance in the management of Douglas fir forests of western Washington and Oregon because of its relation to natural regeneration.

IN THE Douglas fir region the usual practice has been to clear cut the timber and burn the logging slash broadcast. More or less natural restocking occurs on perhaps three-fourths of the cut-over areas; the others remain treeless. Restocking similarly follows crown fires in virgin timber. Where natural reproduction does come in the seedlings may vary in age from 1 to 20 years or more. They occur in greatest abundance close to green timber, but a few may be found a mile or more from the nearest living tree.

What is the source of this reproduction? Does it come from seed which has been lying dormant in the soil and duff, or does this natural restocking come chiefly from seed cast annually by living trees in the vicinity? It is important to know the source of this natural restocking because one plan of forest management may be indicated if restocking will come from nearby green trees, whereas an entirely different plan may be required if restocking can be counted on to come from seed lying dormant in the forest floor. It is obvious that unless seed is capable of lying dormant in the soil for several years, natural restocking over a period of years can not be expected from that source of seed. It is well known that Douglas fir seed can be held successfully for several years under root cellar or cold storage conditions, but just how long this seed retains its viability after it falls from the cone and becomes imbedded in the forest floor has never definitely been determined. This paper describes the results of experiments made to test the life of Douglas fir seed when stored in the soil or duff.

A great deal of work has been done by other investigators on the general subject of seed life, but the most notable work on the life of Douglas fir seed in the forest floor was that done by Hofmann prior to 1925 (1 and 2). Working on old burns several years after the fire, he found seedlings of different ages at such distances from living trees (up to 1½ miles) that he assumed the seed could not have been carried there by the wind. (At that time no accurate information was available regarding the distance seed is carried by the wind.) The obvious conclusions arrived at were that the seed lay dormant in the forest floor at the time of the crown fire, was uninjured by the fire, and germinated sporadically in the years that followed. Six years was set as the approximate length of time that Douglas fir seed would remain viable in the soil or duff. Hofmann sought to check his conclusions by placing seed in duff storage and testing a portion of it annually for germination. Unfortunately, his seed containers were disturbed by rodents after the first year and the test was not continued. It was this latter method of study that was followed by the writer.

The study was conducted in the Wind

River Valley in southwestern Washington within the commercial range of Douglas fir. To avoid possible errors that might occur in a single series of tests or arise from differences in seed quality or yearly weather variations, three separate series of tests were made, each successive series being started while the preceding one was still under way. Series No. 1 was started in September, 1925, and continued for a period of four years; series No. 2 was started in 1928 and concluded in 1932; series No. 3 was started in 1930 and is now practically completed.

The procedure in all three series of tests was similar except in regard to the number of seeds stored and the place where germination tests were made. Fresh seed was collected in the immediate vicinity for each series and was placed in soil or duff storage promptly after harvesting. The soundness of the seed was determined by making cutting tests and also by placing a sample of each lot in the Wind River Nursery cold cellar and testing it for germination the following spring.

In these studies an effort was made to stimulate as nearly as possible the natural storage of seed as it falls from the cone and is worked into the soil or duff by rodents, falling debris, rain, or logging. Rodent-proof enclosures were constructed under a virgin Douglas fir timber stand and also in an adjoining logged-off area. Sections of duff and soil 4 inches wide, 4 inches deep and 18 inches long were taken from these enclosures and placed in containers made of ¼-inch mesh screen. The seed to be stored was embedded in the soil and duff of the containers and these (with their charges of seed, soil, and duff) were placed in the same holes from which the sections of soil and duff had been taken. Each container was divided into three 6-inch compartments. The seed was so placed in these compartments that when the container was set in the soil for storage, the seed in compartment No. 1 would be 2 inches below the surface, in No. 2, 1 inch below the surface, and in No. 3, just under the surface.

Each spring for four years following storage one container was taken up from the forest area and one from the cut-over area; germination tests were then made of the seed. In addition, the containers left in soil or duff storage for the second, third and fourth year tests were watched for germination of seed in place.

Series No. 1—Test Started in September, 1925

A cutting test of 200 seeds of the lot used in series No. 1 showed it to be 70 per cent sound. One thousand seeds, or approximately 700 sound seeds, were placed in each of the three compartments of the eight seed containers that were prepared for storage. Four of these containers were stored in the enclosure under virgin timber and four in the enclosure on logged-off land.

Early in April 1926, when the first containers were taken up from each enclosure, germination had started. The germination tests were made in open seed beds in the nursery. No effort was made to separate the seeds from the soil or duff; instead, the contents of each compartment (seed, duff and soil) was spread over separate squares in the seed bed and enough screened soil sprinkled on to cover to a depth of one-half inch. The germination bed was then given the same shade and watering as other seed beds in the nursery and, as seedlings occurred, they were recorded and removed.

The germination obtained from this soil and duff-stored seed in series No. 1 is shown in Table 1. It will be noted

hat no germination was obtained after he first year in this series of tests. Table 1 also shows, for comparison, the germination obtained from the sample of seed which had been stored over winter in the nursery cold cellar.

The first summer following duff storage, while these germination tests were being made in the nursery, germination was taking place in all containers that remained in storage under the timber and in the logged-off area. It was not possible to determine just what per cent of germination took place in the containers, but there was direct evidence that vigorous germination does take place both under the timber and in the open the first season after seed fall. In this first year following storage, seed placed just under the soil or duff surface in the containers produced seedlings, but the seed germinating at one and two-inch depths seldom was able to push through to the surface and produce seedlings. No germination whatever was observed after he first year in the containers left stored n the soil and duff.

In the fourth year of the study (1929), when the containers were taken up for the annual germination test, 300 seeds were sent to the Portland office of the Division of Forest Pathology for examination. Only one full seed was found in the lot, and this was chalky and dead in appearance. From this examination it was evident that all viable seeds had either germinated or decayed after four years of soil or duff storage.

Series No. 2—Test Started in September, 1928

Series No. 2 was similar to series No. 1 in procedure except that a sufficient quantity of seed was used to provide 1,000 sound seed instead of 700 for each compartment of the containers. Four containers were stored under the timber as in series No. 1, but because of scarcity and poor quality of seed, only one container was stored in the soil on the logged-off area. One container was taken up from under the timber each year for the germination tests; the lone container

Table 1

GERMINATION OF SEED STORED IN SOIL AND DUFF IN PER CENT OF SOUND SEED STORED[1]

Germinating seasons after storage	Under virgin timber, Depth of storage: Surface	1″	2″	On logged-off land, Depth of storage: Surface	1″	2″	Supplementary check (seed stored in nursery cold cellar): Cutting test	Germination
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
				Series No. 1—1925 seed				
st (1926)	23.0	30.0	15.4	28.3	3.7	0	70	48
nd (1927)	0	0	0	0	0	0		
rd (1928)	0	0	0	0	0	0		
th (1929)	0	0	0	0	0	0		
				Series No. 2—1928 seed				
st (1929)	64.9	73.8	69.2	No test	No test	No test	33	16
nd (1930)	.4	.4	1.2	0	0	0		
rd (1931)	0	0	0	No test	No test	No test		
th (1932)	0	0	0	No test	No test	No test		
				Series No. 3—1930 seed				
st (1931)	50.5	35.2	33.1	65.6	63.0	71.0	68	26
nd (1932)	0	0	0	0	0	0		
rd (1933)	0	0	0	0	0	0		

ote: There were approximately 700 sound seeds in the surface, one and two inch compartments of the containers in series No. 1 and 1000 sound seeds in each compartment in series Nos. 2 and 3.

in the logged-off area, however, was not taken up until the second year.

Germination was starting when the first container was taken up in the spring of 1929. The germination obtained in the first and following years of this series of tests is shown in Table 1. There was abundant germination the first spring following storage; this agrees with results obtained in series No. 1. In the second year of the test very light germination was obtained from one lot of seed, and this does not agree with results in series No. 1. During that year, however, volunteer seedlings occurred elsewhere in the nursery, and it is very likely that this germination originated, not from the seed held two years in storage, but from wind-blown seed from surrounding hills. No germination whatever was obtained in the third and fourth years.

The behavior of seed left in soil and duff storage in series No. 2 was similar to that of series No. 1. There was evidence of vigorous germination in place the first summer following storage but none thereafter.

Series No. 3—Study Started in September, 1930

Series No. 3 was similar to series No. 2 in every way except that the full 4-year quota of seed containers was placed both under the timber and in the logged-off area and all germination tests were made in clean soil under glass in the greenhouse. This test has now been carried through its third year.

As in series Nos. 1 and 2, germination was starting when the containers were taken up for the first year's tests.

The germination obtained in this test from duff and soil-stored seed is shown in Table 1. The good germination obtained the first year checks with the results of series Nos. 1 and 2. The entire absence of germination after the second and third year of duff or soil storage checks with the results of series No. 1 and strengthens the suspicion that the germination obtained in the second year of series No. 2 was from foreign seed and not from that held for two years in duff or soil storage.

Vigorous germination the first summer following storage was noted in the containers remaining in soil or duff storage, but, as in series Nos. 1 and 2, no germination in place was noted after the first year.

Results Substantiated by Related Studies

While the foregoing germination tests were under way, various other studies were made that shed additional light on the life of seed in the soil or duff.

In the Wind River Valley and elsewhere in the Douglas fir region, hundreds of sample plots were established to study natural reproduction on logged-off land. These plots, which have been examined regularly by the writer for the past eight years, show certain definite results that have a bearing on the life of seed after it falls:

1. Seedling crops fluctuate with the cone crop of the previous year; there is an abundance of seedlings if the cone crop was heavy and few or none if the cone crop was light.

2. Density of stocking usually decreases as the distance from living trees increases.

3. No seedlings were found on burned areas unless a seed crop had occurred since the fire. Seedlings often occur on sample plots, even when burned several times, if the last fire is followed by a seed crop and there are living trees within a reasonable distance.

4. Trees seriously injured by fire but

not killed outright often live from one to ten years and produce seed during this time.

Groups of sample plots under virgin timber also indicate that seedling crops fluctuate with the cone crops of the previous year, just as they fluctuate on plots in the open. Moreover, Douglas fir seed planted under the timber produced a light germination the first year and none thereafter, and these results indicate that Douglas fir seed falling under the timber either germinates or decays within a year after it falls. All Douglas fir seedings occurring under the timber died the same season in which they germinated. Although it was eagerly sought, no direct evidence was found to indicate that seed stored in the soil or duff retains its viability for more than one year after it falls from the cone.

Recent studies of seed dissemination (3) and air movement (4) indicate that uneven-aged stands of reproduction which occur at long distances from living trees need not originate only from seed that lay dormant in the soil or duff for an indefinite period of years; these stands may spring from wind disseminated seed which is produced from year to year. For example, Douglas fir seed released by the author at a point 200 feet above ground when the wind velocity was 23 miles per hour was carried as far as 3,500 feet over level fields. Stronger winds, or winds with vertical as well as horizontal movement, unquestionably carry seeds many times farther. Vertical air currents, with velocities of from 2 to 10 miles per hour caused by superheating of surface atmosphere, are not uncommon. Where this upward movement occurs, it may equal or exceed the rate of seed fall which is approximately 3 miles per hour; thus seed may be carried great distances even by light winds and restock areas that formerly were believed to restock only from duff-stored seed.

Seeds of other tree species may retain their viability for a period of several years in soil or duff storage, and there may be conditions in nature under which some Douglas fir seed may remain viable for more than one year. These studies, however, indicate that if any Douglas fir seed does live beyond the first year, it does not live in sufficient quantity to become a factor in Douglas fir silviculture. Where restocking follows logging, it originates from (1) seed that was cast the season immediately previous to cutting and which was not destroyed by the usual slash fire, or (2) from wind disseminated seed cast by seed trees or nearby green timber in the years following the fire.

Summary

Three series of germination tests were made to determine how long Douglas fir seed retains its viability under natural conditions of storage in the soil or duff. These tests now cover a period of eight years.

In each series of tests consistently good germination was obtained from the seed taken up the first spring following storage in the soil and duff, but no germination was obtained from seed taken up the second, third, or fourth year after storage.

In each series of tests, the seed left in soil or duff storage for two, three and four years gave results similar to those obtained in the germination tests. The seed left stored in the soil or duff germinated in place the first spring and summer following storage, but no germination occurred in later years.

These results were substantiated by findings in the field in connection with other natural reproduction studies.

From these studies, therefore, the only conclusion that can be reached is that Douglas fir seed not eaten by birds, insects, and rodents either germinates or decays within a year after it falls, both under virgin timber and on open logged-off land.

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In my opinion forestry is associated in a most intimate and remarkable way with the best phases of American social and political development. If healthy tendencies triumph, forestry as an opportunity is in that degree made more attractive. If, on the other hand, debasing tendencies get the upper hand the principal incentives for a young man to take up forestry will disappear.

The profession of forestry, while by no means confined to public service, has public service as its solid foundation and this has always been true and will largely continue to be true in the future. Beginning in the national forests and extending widely to state organizations, forestry has largely been kept free from political influences perhaps to a greater degree than many other lines of public service. It is because of this fact that schools of forestry have been built up, twenty-six in number, turning out over five hundred trained men per year who expect to make forestry their career, having in mind to a great extent this public service. Within the last year, for the first time in my thirty years of experience, there threatens to be a breakdown of this principle by the injection of political appointments, especially in the work of the Civilian Conservation Corps, and in the threat to extend it to the National Forest Service by a transfer to the Department of the Interior. Just to the extent that this vicious political principle invades public forestry the profession will cease to be attractive.

Forestry as a career whether in public work or in the employment of industry or private estates calls for a greater breadth of training and viewpoint than any other profession. Certain professions concentrate on physical technique of production, others on economics or public service, still others on business management. Forestry to succeed must combine all three of these fields. When we add to this balanced training and practice the fact that forestry also combines to a remarkable degree the outdoor activities with the indoor or desk administrative work, we have another reason why foresters who choose and succeed in this profession are usually among the highest types of normal, progressive, sane Americans.—H. H. CHAPMAN.

FUEL TYPE MAPPING IN REGION ONE

By L. G. HORNBY

Northern Rocky Mountain Forest and Range Experiment Station

The mapping of a fuel is simply the identification of the place where a specific kind of fire behavior and difficulty, or expense, of control are expected. The article presents, in abbreviated form, instructions issued to fuel mappers in northern Idaho and western Montana. Under this method, which was developed incidental to fire control and transportation planning, fifteen million acres of national forest fuels have been mapped to date.

THE reason for making a fuel map is to know, before a fire occurs, under a given degree of weather langer, what speed and strength of atack will be required.

The rate at which a fire will spread etermines how many chains of fire line vill be produced per hour. The diffiulty of firefighting caused by slope and oil, together with amount, size, arrangeient and species of fuel along the perieter of the fire, determines how many ian-hours of work will be required for ach chain of fire line. Evidently the ian-hours per chain multiplied by the umber of chains to be worked gives the refighting job to be done. Fuel maps vill show, according to the mapping legnd, the probable *rate of spread* and the *esistance to control.*

The first use of this map will be in iaking preparations for fires that may ocır, stationing firemen for detection, and ationing one or several of them within ermissible travel-time distances as necestated by fuels. The most frequent use ill be by dispatchers sending men to res.

Firemen and their expensive improveents, including roads, must be located in lation to fuels and cannot be moved nnually. Mappers are expected to rate iels as they will be five years after amination. Estimates of such known ianges as result from burns, blowdowns, idemics and cutting operations are reiired.

Ratings will assume conditions after a month of continuous mid-summer drouth has prevailed.

Consideration will be limited to the first few hours after a fire is large enough to be discoverable, i.e., to the elapsed time required for travel and firefighting.

The scale one inch to the mile will be standard for present field mapping. For planning purposes field maps will be reduced to half-inch scale.

This method omits a detailed inventory on the assumption that the best conclusions can be drawn by men looking at the amount, arrangement and continuity of fine fuels and their exposure to sun and wind. It is adapted to refinement as usable data on combined influences become available. It states concisely what planners and dispatchers need to know. Fine fuels consist of such materials as branches of trees less than one inch in diameter, shrubs and herbaceous plants, loose, rotten wood and bark, frayed, broken trunks, open rotten checks, moss and dead needles on snags and windfalls, and needles, leaves, duff, weeds, grass and moss on the forest floor.

Rate of Spread

Four classes are recognized. The mapper should endeavor to visualize all the different rates of spread that have occurred. He should divide these into three equal parts called *low*, *medium*, and *high*, and assign each fuel he encounters to

TABLE 1

DIFFERENCES IN MOISTURE CONDITIONS IN STANDS OF VARYING DENSITY

Timber density	At 9:00 A.M. per cent moisture[1]	At 4:30 P.M. contents per cent
Clear-cut area	5.3	2.4
Half-cut area	6.0	4.4
Full-timbered area	8.7	6.1

[1]Moisture is in percentage of oven dry weight of cylinders.

one of these classes. A fourth class, *extreme*, has been specified. It is considered an exclusive part of the highest class reserved for the worst parts of blowdowns, cut-over areas and single burns. Grass is eliminated.

Where large fires are observed to have stopped naturally, the influences of precipitation, high humidity, change of wind and night cooling, working singly or in combination, have frequently been the cause rather than the fuel.

Reliable guides to probable rate of spread are available in consistent data collected at widely separated forest experiment stations.

EFFECT OF DENSITY OF CANOPY

At Priest River, Northern Rocky Mountain Experiment Station, U.S.F.S.—H. T. Gisborne has established three weather stations about 500 feet apart in a line approximately parallel to the prevailing wind direction. All are on a flat that originally bore a dense stand of overmature white pine-hemlock type. The wind and sun have full access to the station farthest south, where the timber was clear-cut. Northward, with the wind, the next station is in timber whose canopy was half-cut. Around the third station the natural forest was untouched. It is protected from wind by about 500 feet of half-cut plus 300 feet of virgin timber.

The week August 10-16, 1931, was selected for study of differences at these stations because it satisfied the requirement to have no rain and to be in mid-fire-season of a disastrous year. Extreme burning conditions had been demonstrated on opposite sides of this set of weather instruments. For any factor seven daily records were averaged for each hour of the day to obtain a representative day.

It was found that between 7:00 A.M. to 4:30 P.M. temperature was high and humidity low, according to openness of the stand.

Half-inch wood cylinders, ten inches above ground, showed the record given in Table 1.

Wind influences rate of spread in two very different ways. In places exposed to dry, prevailing winds, fuels are being dried and prepared for more rapid spread than in sheltered places. After ignition, wind increases the rate of spread by supplying oxygen for combustion. Varying with the steepness of slope, rising hot air currents prepare fuels up the slope ahead of a fire for rapid combustion, while the cooler air, coming in below, provides oxygen.

It will be noted that tree crowns and trunks cut the afternoon wind velocity of the open down to about one-twentieth in the full-timber, at nine feet above ground. Undoubtedly the wind was moving as fast above the tree crowns as it was at the clear-cut station, and fine dead fuels in the crowns would exhibit the same tendencies toward fast spread except that evaporation would modify it. Small changes in humidity exert a much greater influ-

TABLE 2

THE AVERAGE DAILY RECORD OF WIND AT GISBORNE'S THREE WEATHER STATIONS.

Timber density	Wind in miles per hour, averag[e] From 5:00 P.M. to 9:00 A.M.	From 9:00 A.M. to 5:00 P.M.
Clear-cut area	1.2	3.8
Half-cut area	0.6	2.3
Full-timbered area	0.1	0.2

nce on inflammability than small changes n temperature.

At Northeast Forest Experiment Sta-ion, U.S.F.S.—Data from Massachusetts vere published by Paul W. Stickel in *Pulp and Paper in Canada*, January, 1933. Comparisons of inflammability were pre-ented for four degrees of thinning. The onclusions agree with the data from Priest River.

Effect of Topographic Shelter

In Region 1 the prevailing wind direc-ion is from southwest to northeast and nly rarely are fires or fuels influenced y general winds moving in any other irection.

Shade is simply absence of sunlight. Vhatever causes it reduces the amount of adiation received from the sun.

Obviously, slopes bombarded all day nd tilted so as to be perpendicular to ne sun at its highest midday position will eceive the greatest possibly quantity of olar radiation.

Effects of Cover and Topography

At Fremont Experiment Station, U.S.F.S., olorado.—The following information is btained from Carlos G. Bates' article The Transect of a Mountain Valley," *cology*, January, 1923.

For fuel mappers the important contri-ution is a correlation of species as well s density of stands with the inflamma-ility factors, temperature, moisture and xposure. The topography involved is a alley 700 feet wide with axis east-west.

South exposure.—"All of the south ex-osure is subjected to direct insolation at me time during the day and during the ntire year. As a result, high maximum mperatures (150° F.) are recorded at the rface of the soil (60° above the cool-t neighboring site)."

Near the foot of the south exposure only scattered trees of ponderosa pine are able to exist.

The extreme top portion of the south exposure, where Douglas fir is invading ponderosa pine, shows almost as thorough drying of the surface soil as any other portion, but appreciably lower temperatures.

North exposure.—"From the bottom of the valley to almost the top of the north exposure relatively moderate temperatures are experienced, both on account of the angle of incidence of the sun's rays and the completeness of the cover. On the lowest and also steepest portion, the evaporation rate is lowest, the soil temperatures are lowest, the accumulation of moisture is greatest, and the drying of the soil is most gradual. So far as these are the results of steep slope, the conditions would probably exist in a degree if all cover were removed."

Spruce, almost pure, occupies the lower part of the north exposure.

"The upper portion becomes progressively warmer and drier. Here, evidently, are encountered about the mean temperature conditions which are favorable to Douglas fir. But it should be noted on all similar exposures, once the Douglas fir forest is established, there is a marked tendency for Engelmann spruce to invade and supersede fir."

Table 3

FIRES JUNE 21-SEPT. 10 OF 1926 AND 1929 COMBINED. ORIGINS IN UNCUT GREEN FORESTS, ATTACKED 0-24 HOURS AFTER IGNITION.

Exposure	Number of fires	Origin to arrival hours av.	Av. size when reached acres	Av. rate of spread acres per hour
NE[1]	397	7.1	0.52	0.07
SW[1]	414	7.0	0.62	0.09

[1]Each direction includes a half circle.

The evidence seems to permit the conclusion that any density of stand, by obstructing wind and sun, makes possible a greater density, accompanied by reduction of inflammability, until a climax is reached.

Fuel mappers are warned against the assumption that all north exposures are moist and cold. West of north-south divides they are dried more by wind than east of those divides. At junctions of valleys north slope vegetation frequently is typical of moderately dry sites.

As the drouth of fire season continues the moisture contents of protected and exposed fuels become more alike. However, analysis of fires that occurred in mid-season of the two worst years out of ten shows that differences still exist.

Fire in Relation to Fuel Type

Green Stands, Uncut, Pole Size and Larger.—From an exhaustive study of rates of spread that occurred 1921-30, it was found that the standard types lined up in the following descending order:

1. Brush-grass
2. Ponderosa pine
3. Larch-fir
4. Douglas fir and lodgepole pine
5. White pine and cedar-hemlock
6. Subalpine
7. White fir and spruce

This order is approximately the same as density of stand and is consistent with Bates' data from Colorado. The same relative order was found for any severity in burning conditions.

Unfortunately, the mere presence of a particular timber type does not determine

Table 4

EXAMPLE OF FIRE SPREAD AND RESISTANCE RATINGS FOR VARIOUS KINDS OF FUEL

Example no.	Description of fuel E=extreme, H=high, M=medium, L=low	Rate of spread	Resistance to control
	Ponderosa pine, mature stands on SW slopes		
1	with reproduction scattered or absent	H	L
2	With reproduction moderately dense	H	M
	Spruce, white fir or cedar-hemlock mature, normally dense in protected bottoms. If rough snags are conspicuously present and green trees are limby, connecting fuels on ground to mossy		
3	crowns	L	H
	If snags are smooth and thinly scattered while		
4	green trees are clean of moss and brushy limbs	L	L
	White pine, larch-fir, Douglas fir or lodgepole pine, normally dense stands, windfall and snags almost absent, ground vegetation conspicuously		
5	low shrubs; on protected flats and NE exposures	L	L
	On exposed flats and gentle SW exposures with usual increased openness and prevalence of grass, with snags and windfall moderate but		
6	not continuous	M	M
	Any species except ponderosa pine; mature dense stands, 80 per cent + killed by ground fire or epidemic, leaving all dead foliage on trees; half or more of dead trees down and not completely shaded by reproduction. On ex-		
7	posed SW slopes	E	E
8	On protected NE slopes	H	E
	If same stands burned hot enough to consume		
9	fine fuels. On exposed SW slopes	H	H
10	On protected NE slopes	M	H

he probable rate of fire spread or re-istance to control at a specific spot. It imply indicates the degree to which part f the influences are present. The age f a stand, in combination with the mount and condition of older or young-r intermixed dead and green trees, means nuch.

Burns, Cut-over Areas, Blowdowns, nags, Moss.—As burns produce open-ess of stand it might be expected that ates of spread there would be faster than n green timber of the same type. This endency was only slightly exhibited by he 1,536 fires recorded as originating here. The condition commonly called urn has included large areas of brush nd reproduction up to 30 years old. This growth is performing the same func-ions of shelter as mature stands to the egree that fine fuels are being shaded nd air movement around them prevented. Between burned areas and unburned clear-ut areas, bare ground is frequent in the ormer and rare in the latter.

Cutting operations, in general, have roduced a high degree of openness in ands. It was found that rates of spread onformed more to a completeness of lash disposal than to timber type. Un-er all severities of weather, rates of pread were much faster in cut-over areas han in uncut, green forests or in single urns.

The complete blowdown of a dense and, fully exposed to sun and wind, ust be given the highest possible rating.

Initial ignitions are not likely to pread aerially between snags that are ore than 75 feet apart. Examination of e fuel on the ground at the foot of nags and between them is necessary to nown the probability of fire running ere.

Fuel mappers will recognize moss only conjunction with other fuels. The most nportant association is with loose, dead rk and dead crowns.

Resistance to Control

Resistance to control is the intensity of firefighting difficulty. It is the amount of work per chain, or other unit, of perimeter length.

The degrees of resistance to be mapped are designated in the same terms as used for rates of spread—low, medium, and high—with a fourth class, extreme, to be used for conspicuously difficult fuels.

The important factors that determine resistance are:

Fuel conditions	*Existing in*
Amount	Standing green timber
Arrangement	Snags
Size	Windfall and slash
Species	Brush, reproduction and grass
Decay	Duff and roots

Trenching and Dirt-Smothering Chance

Roots, soil, rocks, slopes.—The fuel mapper will assume the method of attack to be by ordinary hand work, using the most suitable tools. In rating resistance, he is to judge only the work required to corral fires and to hold them through the midday burning period. He should endeavor to visualize an efficient fireman, doing whatever work exists at the spot under consideration.

Ratings for Typical R-1 Conditions

At five training camps for fuel mappers 90 men, representing 10 national forests, agreed on 42 ratings to be assigned to typical fuels of Region 1. From them the examples in Table 4 are given as guides to the reasons for increasing ratings as fuel dangers increase.

The production of a map, showing the location of each class of fuel, is simply a step toward providing protection proportional to the need for it. Analysis has shown what rates of spread to expect and what progress different numbers of men can make. From this information an allowable travel time has been derived for each fuel class.

Another necessity satisfied by the fuel map is in making total danger ratings for forest areas that differ in the three essential considerations, fuel danger, values at stake and frequency of occurrence. By adding together the dangers of small areas the total amount covered by different detectors, smokechasers, roads and trails, per dollar of annual expense has been determined.

"The independent effort of an individual may be but a feeble gesture . . . . But when he joins in mass formation with his neighbors the same effort becomes an irresistible and mighty force. *Cornellian Council Bulletin*, Oct., 1934.

GROWTH IN VIRGIN PONDEROSA PINE STANDS IN CENTRAL IDAHO

By CHARLES A. CONNAUGHTON

Intermountain Forest and Range Experiment Station

It is commonly believed that no significant net growth occurs in virgin stands. To determine the accuracy of this empirical observation as applied to ponderosa pine (*Pinus ponderosa*) in central Idaho, a series of permanent sample plots have been maintained and remeasured periodically since 1913. These plots now provide data on growth and development of both the stand and the individual trees.

THE results at the time of the third remeasurement in 1931 show that an appreciable net increment has accrued, indicate the development of the younger age classes, show the causes and extent of the normal mortality and aid in furnishing a guide for marking stands of this type. Each of these items should be of value in facilitating management of virgin stands. The data presented will not be directly applicable to stands outside of Idaho but will merit consideration in any ponderosa pine forest where the distribution of age classes approaches those included in this study. The large areas of relatively inaccessible, virgin ponderosa pine forests that cannot be marketed at present accentuate the importance of these results.

Description and Measurement of the Plots

The plots are located in two minor drainages of the South Fork of the Payette River on the Payette National Forest. They include twelve plots varying in size from 4.11 to 5.00 acres and one of 18.46 acres, making a total of 74.17 acres under observation. The altitude ranges from 3,800 to 4,500 feet. The mean annual precipitation is estimated at 22 to 24 inches. The plots are all within the ponderosa pine type but the local composition varies from almost pure pine on the exposed south and east slopes to a predominating mixture of Douglas fir (*Pseudotsuga taxifolia*) on the north and west slopes. The surface soil, which is derived from an easily disintegrated granite rock, varies from a porous, coarse, gravelly condition on the south and east slopes to a sandy loam containing a heavy organic mixture on the north and west slopes. The slope of the plots varies from 5 per cent to 35 per cent. The stand is all-aged, being made up of intermingling even-aged groups. The largest trees, no doubt, exceed 400 years in age. The site, based on the height of the average dominant tree, as determined from the Forest Service classification is good class III or poor class II. This site, while not uncommon, is higher than the average in central Idaho.

The first remeasurement and report on these plots was made by Korstian (2) in 1918-1919. The next remeasurement was made in 1931. All trees 3.6 inches d.b.h. and over have been measured and tagged at each measurement. The diameter limit of merchantability used for calculating the board foot volumes was 9.6 inches d.b.h. Volume in board feet was determined by the Scribner Decimal C volume table. Each individual tree was classified in accordance with a tree classification prepared by Dunning (1).

Results

NUMBER OF TREES AND AVERAGE STAND PER ACRE

The original and present distribution of the stand by species in each diameter class is presented in Table 1. The number of trees, average diameter of the stand, volume in cubic feet and volume in board feet per acre are shown by aspects and species in Table 2. These tables are presented as an aid in picturing the stocking and in interpreting increment and mortality figures. No data on normal stocking of an unevenaged virgin ponderosa pine stand are available but studies made in eastern Oregon (3) and comparisons with other central Idaho stands indicate that the present stocking and volume on these plots is a little better than average.

The plots have been combined and grouped by aspects because of similarity in site conditions and for convenience in treatment of the data. The data from the south and east slopes are considered in one group, north and west slopes in another, and those from the more or less flat basins in a third group. These divisions represent the three distinct topographic types characteristic of the central Idaho ponderosa pine region and each presents a different combination of the two species comprising the stand.

As shown in Table 2, approximately 76 per cent of the volume in board feet on the combined plots is ponderosa pine and 24 per cent is Douglas fir. Ponderosa pine varies from approximately 90 per cent of the total stand on the south slopes to as little as 46.5 per cent on the north slopes. Similar percentages determined on the basis of volume in cubic feet are slightly more in favor of Douglas fir because this species, as indicated in Table 1, has a greater proportion of its total number of trees in the lower diameter groups.

Periodic Annual Increment and Mortality

The gross increment in volume, as here used, represents the increment on the trees which were above the minimum measured d.b.h. at the beginning of the period, together with the volume of the new trees which have subsequently attained that diameter. The volume of the trees over the minimum d.b.h. limit which died during the period is subtracted from the gross increment to obtain the net increment. Table 3 presents a summary of the growth on the sample plots grouped by aspects.

An important feature brought out by

Table 1

NUMBER OF TREES PER ACRE IN 6 INCH DIAMETER CLASSES

D. b. h. classes Inches	Number of trees per acre					
	Ponderosa pine		Douglas fir		Total	
	1913[1]	1931	1913[1]	1931	1913[1]	1931
3.6- 9.5	4.96	18.05	11.50	13.74	16.46	31.79
9.6-15.5	3.83	3.46	5.15	5.26	8.98	8.72
15.6-21.5	4.69	4.18	3.76	3.88	8.45	8.06
21.6-27.5	5.33	5.04	1.96	2.09	7.29	7.13
27.6-33.5	3.32	3.76	.89	1.15	4.21	4.91
33.6-39.5	1.79	2.01	.19	.21	1.98	2.22
39.6+	.62	.74	.08	.11	.70	.85
Total	25.54	37.24	23.53	26.44	48.07	63.68

[1]Plots established in 1914 included.

Table 3 is the relation of increment to mortality. The sum of the gross increment for both species on each aspect is practically the same, but due to differences in mortality the net increment on each aspect is materially different. On the heavier stocked north and west slopes the mortality was equal to 80 per cent of the gross increment in board feet. In the more open, exposed basins and on the south and east slopes the mortality amounted to only 36.5 and 41.5 per cent respectively. It is significant also to note in a comparison of weighted totals by species that the mortality for each species was approximately 50 per cent of the total gross increment.

Of the two species, Douglas fir shows the greater increment in relation to the growing stock. It produced 33.8 per cent of the net growth in board feet on the combined plots, although it makes up only 24 per cent of the total volume in board feet. This apparent slight superiority in growth of fir over pine is probably largely due to a greater percentage of the fir stand consisting of younger, more thrifty age classes. The differences in total increment between species on the three aspects is largely due to differences in the quantity of growing stock as shown in Table 2.

Increase in Number of Trees

The average number of trees per acre

TABLE 2

AVERAGE STAND PER ACRE OVER 3.6 INCHES D.B.H.—1931

Aspect	Area in Acres	Number of trees		Average d.b.h. Inches		Cubic feet		Board feet	
		Ponderosa pine	Douglas fir	Ponderosa pine	Douglas fir	Ponderosa pine[1]	Douglas fir[2]	Ponderosa pine[1]	Douglas fir[2]
North	19.47	19.98	75.70	14.15	10.51	1,810	3,257	11,788	13,582
South	35.06	43.50	3.96	15.65	16.59	3,865	440	24,462	2,156
Basin	19.64	43.18	17.81	14.17	15.32	3,389	1,484	21,004	6,773
Weighted Total	74.17	37.24	26.44	14.98	11.79	3,200	1,456	20,219	6,378

[1]Volumes for ponderosa pine from tables prepared by Meyer, 1930.
[2]Volumes for Douglas fir from tables prepared by Littlefield, 1921.

TABLE 3

PERIODIC ANNUAL INCREMENT PER ACRE

Aspect	Area in acres	Cubic feet			Board feet		
		Gross	Mortality	Net	Gross	Mortality	Net
			Ponderosa pine				
North	19.47	11.20	12.67	—1.47	83	79	4
South	35.06	40.14	17.22	22.92	253	109	144
Basin	19.64	29.99	14.74	15.25	176	91	85
Weighted Sub-total	74.17	30.07	15.41	14.66	189	97	92
			Douglas fir				
North	19.47	49.25	34.88	14.37	201	148	53
South	35.06	9.26	5.52	3.74	24	6	18
Basin	19.64	22.37	3.05	19.32	109	13	96
Weighted Sub-total	74.17	20.83	10.13	10.70	92	45	47
Grand total		50.90	25.54	25.36	281	142	139

reaching the 3.6 inch diameter limit annually has been 0.89 ponderosa pine and 0.44 Douglas fir. The average number of trees per acre reaching the minimum board foot limit (9.6 inches d.b.h.) annually has been 0.07 pine and 0.13 fir. New trees added 8.3 per cent of the average annual increment in cubic feet and 8.6 per cent of the average annual increment in board feet. These figures show the relatively small increase in volume that has been derived from this source. They also show by comparing the number of trees reaching the two diameter limits that the development of the stand is irregular and that subsequent remeasurements may yield different results regarding new trees.

Causes of Mortality

Table 4 shows the mortality classified by causes insofar as it was possible to determine them. Mortality was recorded for each of the three topographic divisions but in analyzing the data there seemed to be no apparent relationship between aspect and cause of death. Consequently segregation by aspect is not shown in the table.

Approximately 82 per cent of the total loss in volume of ponderosa pine was the result of insect attacks. Most of this mortality was caused by the western pine beetle (*Dendroctonus brevicomis*) attacking overmature trees. The mountain pine beetle (*Dendroctonus monticolae*) has caused some loss in a few small groups of young thrifty trees. The attacks upon ponderosa pine by the mountain pine beetle presumably were occasioned by a heavy infestation of lodgepole pine (*Pinus contorta*) stands in this region. During the last few years this insect has migrated in some instances to ponderosa pine stands and selected young, thrifty trees which resemble lodgepole pine in size and physical appearance. This migration is much less serious in the vicinity of the plots than in some other stands in central Idaho. The loss due to insects on the plots amounted to 80 board feet per acre anually but the infestation can not be classed as epidemic so long as the loss is confined chiefly to scattered overmature individuals. The loss from insects in Douglas fir was a result of an epidemic of defoliators shortly after the plots were established.

Loss attributed to wind and snow was second in importance. The mortality in ponderosa pine was caused largely by windfall of mature trees. The mortality in Douglas fir has been caused both by windfall in the older age classes and by snow damage in the younger age classes. In this locality the weight of snow that

Table 4

AVERAGE ANNUAL MORTALITY PER ACRE BY CAUSES

Cause of death	Ponderosa pine				Douglas fir			
	No. of trees	Average d.b.h.	Cu. ft. vol.	Bd. ft. vol.	No. of trees	Average d.b.h.	Cu. ft. vol.	Bd. ft. vol.
Insects	0.079	22.46	12.56	80	0.025	22.37	4.34	22
Wind & snow	0.017	18.46	1.69	10	0.125	8.05	2.63	10
Suppression	0.031	6.99	0.21	1	0.051	5.73	0.24	0
Porcupine	0.005	6.70	0.03	0	—	—	—	—
Mistletoe	—	—	—	—	0.024	15.53	1.68	7
Fungi	—	—	—	—	0.005	13.87	0.28	1
Lightning	0.001	33.00	0.20	1	—	—	—	—
Unknown	0.011	14.58	0.72	5	0.040	8.13	0.96	5
Total	0.144	17.53	15.41	97	0.270	9.75	10.13	45

accumulates on the branches is not sufficient to cause much breakage but a snow slide on one plot on a north slope was quite destructive to a stand of young Douglas fir. Damage of this sort is very local in extent but may be expected occasionally on steep slopes.

Serious mistletoe (*Razoumofskya douglasii*) infection was confined to Douglas fir. The infection is quite widespread in this species and is taking its annual toll. Visible evidence of death from rot was confined to Douglas fir. The susceptibility of Douglas fir to mistletoe and fungi infection is in contrast to the healthy condition of the ponderosa pine. Approximately 32 per cent of the total loss in volume in board feet on all plots has been in Douglas fir although this species makes up only 24 per cent of the volume of the stand. A comparison on the basis of volume in cubic feet shows the same general relation between the two species.

Loss of volume due to suppression was relatively unimportant. Porcupine damage was confined to ponderosa pine and although noticeable has not been severe enough to cause death of many trees over 3.6 inches d.b.h.

Growth, Mortality and Defect on an Individual Tree Basis

Data on increment, mortality and conditions of the stand thus far have been presented on an acreage basis which is satisfactory from a broad management standpoint. Analysis based on the individual tree is also pertinent to aid in cutting or marking stands of this character. The behavior of a given tree or class of trees in the virgin ponderosa pine stand may not be identical with, but will be fairly indicative of the behavior of that individual or class of individuals left in the residual stand following cutting.

Dunning's tree classification system was used as the basis for the study of individual trees since it is applicable throughout the entire range of ponderosa pine. The data based upon the study of individual ponderosa pine trees are summarized in Table 5. No attempt was made to segregate Douglas fir into tree classes because there is no existent classification that would have universal application.

It is the practice of the U. S. Forest Service when cutting virgin ponderosa pine in central Idaho to reserve 20 to 30 per cent of the volume in board feet of the original stand for seed production and growing stock. Obviously the trees best suited for these purposes are the thrifty, full-crowned individuals which are most likely to survive windfall, insect attack and fire. Selection of the trees best

Table 5

INVENTORY OF PONDEROSA PINE BY TREE CLASSES
ACRE BASIS—1931

Tree class	Total number of trees	Number of merchantable trees	Per cent of merchantable volume	Net increment board feet	Per cent of bd. ft. volume in trees with defect
1	9.67	2.40	6.20	19	25.08
2	11.11	4.35	13.76	34	20.26
3	1.01	1.01	7.08	17	26.41
4	2.87	2.87	21.34	25	36.82
5	3.91	3.91	43.59	—14	44.95
6	7.86	3.88	7.20	10	34.92
7	0.81	0.76	0.83	1	39.49
Total	37.24	19.18	100.00	92	36.60

suited to be reserved is greatly facilitated by use of a tree classification.

Dunning recommends that on the basis of growth and seed production the 20 to 30 per cent of the total volume that is to be reserved in cutting should be drawn from tree classes 1, 2 and 3 with the possibility of desirable class 6 trees where release by cutting is insured. Marking based on tree class will need to be modified somewhat on the ground in order to remove defective individuals, avoid logging damage and for other reasons. Inspection of Table 5 clearly indicates that actual conditions justify the Forest Service practice in central Idaho and Dunning's recommendations. Twenty-seven per cent of the stand by volume in board feet is contained in the three classes most desirable to reserve and 76 per cent of the net growth is occurring in these classes. Therefore if the stand was marked on the basis of tree class alone sufficient volume and the portion producing the major part of the growth would be reserved. From 20 to 26 per cent of the volume in these three classes is subject to defect. Minor defect such as a light fire scar or slight crook is not always serious enough to make removal advisable but assuming that every tree with even a minor defect is cut, approximately 21 per cent of the stand would remain. If this were supplemented by desirable class 6 trees a satisfactory stand would be reserved.

It is significant to note also that on the basis of the present growth rate, the reserve stand under the method of marking suggested would be capable of producing immediately at least 60 per cent as much net increment as the virgin stand. It is to be expected that following release growth will be accelerated. Mortality following cutting might temporarily increase due to windfall or Ips beetle attacks, but under ordinary conditions and reasonable cutting practice it should not be serious in an open-grown stand of this type.

The occurrence of defect and the combined net growth for classes 4, 5 and 7 further indicates the desirability of removing them. Over 40 per cent of their total volume is in trees having some kind of defect and their weighted net growth per acre in board feet is —1.3. The mortality rate causing this negative increment was largely due to insects in classes 4 and 5 and suppression in class 7. Fire scar and poor form accounted for the majority of the defect in these classes. Insects were responsible for the bulk of the loss in classes 1 and 2, and damage to form from injury by porcupine was the biggest factor contributing to defect. Mistletoe is practically absent on ponderosa pine but it is present on 19 per cent of the Douglas fir. Observations based on cutting in stands similar to this indicate that invisible interior defect is small for ponderosa pine and relatively high for fir.

Summary and Conclusion

There is significant net growth in virgin ponderosa pine stands in central Idaho. Over a period of 17 years the annual gross increment has been 50.9 cubic feet or 281 board feet. Mortality has amounted to approximately 50 per cent of the gross increment, leaving an average annual net increment of 25.4 cubic feet or 139 board feet per acre.

The average annual net growth per acre has been 92 board feet for pine and 47 board feet for Douglas fir. Gross growth has been practically the same for all aspects but net growth differed materially. Approximately 8 per cent of the annual increment was derived from new trees.

Insects, which cause an average loss of 102 board feet acre annually, were the chief source of mortality. This is con-

sidered a normal mortality from this agency over a period as long as 17 years. Wind and snow caused an average loss of 20 board feet per acre annually. Other agencies causing mortality were secondary in importance from the standpoint of volume in board feet.

The Dunning tree classification system is considered a desirable guide in marking a virgin stand for cutting.

Virgin ponderosa pine stands are "paying their way" and probably will continue to do so if not overtaken by some disastrous catastrophe such as an insect epidemic or fire. Growth in virgin stands should be taken into consideration in the preparation of management plans. Lack of immediate markets for potentially valuable timber should cause little concern providing adequate forest protection is assured.

References

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BRIEFER ARTICLES AND NOTES

A Method of Determining Spacing in Thinning

In recent ECW and NIRA thinning work conducted by the Northern Rocky Mountain Forest Experiment Station, a quick and practical method of determining proper spacing was needed as a guide in marking. To meet this need the accompanying diagram was prepared, showing values for diameter, basal area, land area per tree, and number of trees per acre corresponding to values for both equilateral and square spacing.

Actually, of course, trees grown naturally in the woods are not usually so distributed that they can be thinned to either the theoretically ideal equilateral spacing, with all adjacent trees equidistant from each other, or the slightly less desirable square spacing. In natural-grown stands the best spacing that can be effected in thinning averages somewhere between the two. The diagram serves well, however, in determining approximately what space should be allotted to a tree of given diameter in reducing the basal area of the stand per acre to a given figure.

For field use the procedure can be simplified very materially by expressing spacing in terms of inches of d.b.h., as in Table 1, computed directly from the diagram.

It is evident that spacing in feet per inch of d.b.h. is practically a constant for any given basal area. For practical purposes the averages given in the table may be summarized in three easily remembered figures, as follows:

Basal area per acre	Spacing per inch of d.b.h.
Square feet	*Feet*
90-110	1-2/3
110-140	1-1/2
140-160	1-1/3

In applying these constants to determine the proper spacing between two

Table 2

BASAL AREA PER ACRE IN SQUARE FEET

D.b.h Inches	Spacing in feet per inch d.b.h. 90	100	110	120		140	150	160
4	1.70	1.70	1.60	1.50	1.45	1.40	1.35	1.30
5	1.80	1.70	1.60	1.50	1.45	1.40	1.35	1.30
6	1.75	1.60	1.60	1.50	1.45	1.40	1.35	1.35
7	1.75	1.65	1.60	1.50	1.45	1.40	1.35	1.30
8	1.75	1.65	1.60	1.50	1.45	1.40	1.35	1.30
9	1.75	1.65	1.60	1.50	1.45	1.40	1.35	1.30
10	1.75	1.60	1.60	1.50	1.45	1.40	1.35	1.30
11	1.75	1.60	1.60	1.50	1.45	1.40	1.35	1.30
12		1.65	1.60	1.50	1.45	1.40	1.35	1.30
13				1.50	1.45	1.40	1.35	1.30
14						1.40	1.35	1.30
15						1.40	1.35	1.30
Average	1.75	1.65	1.60	1.50	1.45	1.40	1.35	1.30

trees differing in diameter, the two spacing figures should be averaged. For example, if the desired stocking is 120 square feet basal area per acre the spacing for 10-inch trees is 10 x 1½ feet, or 15 feet, that for 6-inch trees is 6 x 1½ feet, or 9 feet, and the approximate correct spacing between a 10-inch tree and a 6-inch tree is the average of 15 feet and 9 feet, or 12 feet. By keeping these constants in mind it is possible, with a little practice, to mark a stand to any given density of stocking very consistently.

Obviously, the diagram presented can be used in a number of other ways, as for example to determine the basal area per acre of a stand of given average spacing and diameter.

KENNETH DAVIS,
Northern Rocky Mt. Forest and Range Exp. Sta.

FIFTY DOLLARS FOR A NEW FORESTRY TERM

For the best word or term that will distinguish commercial forestry from non-commercial forestry, a member of The American Forestry Association, who prefers to remain unknown, offers a prize of $50.

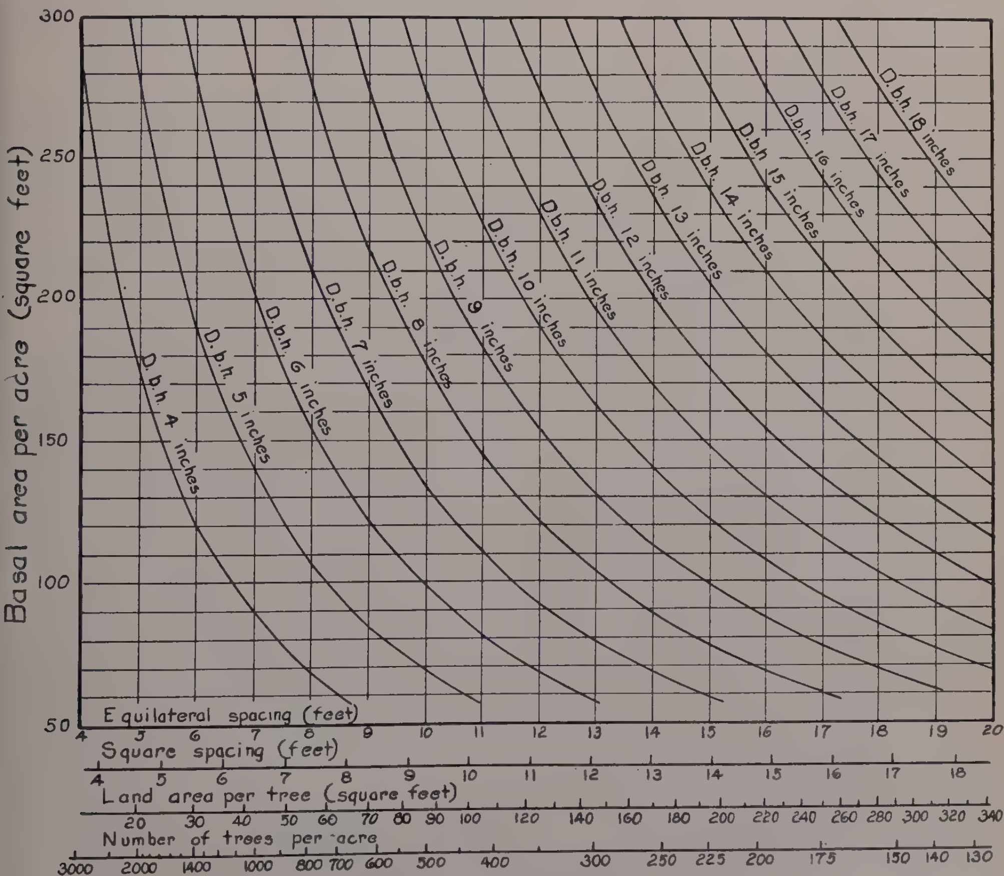

Fig. 1.—Spacing diagram.

It is the feeling of the donor that the term "Forestry," which is applied to the administration of uneconomic forests such as those designated for recreation, research, watershed protection and erosion control, as well as to commercial forests, which involve the economic growing of forest trees to be harvested on a profitable basis like any other crop, is too indefinite to clearly differentiate the two broad objects of forest management. In the interest of clearer public understanding and advancement of industrial forestry, he believes a new term should be coined that will more sharply and definitely express its meaning and significance.

His only stipulation that the word or term must be euphonious and at the same time scientific.

Anyone is eligible to compete, regardless of training, profession, or membership in The American Forestry Association. The contest closes on March 31, 1935, and no entry will be considered bearing a later Post Office cancellation date. The winning word, or term, will be announced in the May issue of *American Forests*.

Each competing term must be printed on a plain envelope with the name and address of the person sealed within the envelope. Any number of words or terms may be submitted by a single contestant, but each one must be printed on a separate envelope with the name and address of the contestant sealed inside.

Address all entries "Forestry Term Contest," The American Forestry Association, 1713 K Street, N. W., Washington, D. C. No entries will be returned.

Prove Dutch Elm Disease Carried by Bark Beetles

Definite proof that the smaller European elm bark beetle is a carrier of Dutch elm disease has been obtained by entomologists in the U. S. Department of Agriculture, according to an announcement made at a conference on this disease on December 5 by William Middleton, of the Bureau of Entomology and Plant Quarantine. Mr. Middleton and his co-workers have proved that beetles from infected elms are contaminated with the fungus of the disease and transmit it when feeding in the crotches of healthy trees.

Three instances of such transmission have been obtained on three different elm trees. In two cases the beetles used in the experiments were reared from diseased elm bark and wood kept in rearing cages and in the third case the beetles used were collected from an infected elm growing in the open. The experimental work was carried on in a greenhouse at Morristown, New Jersey.

The possibility that many other insects, including other boring species and sucking and leaf eating insects, are carriers of the fungus of Dutch elm disease remains to be studied. So far, however, the bark beetle, Scolytus multistriatus, is the only insect known in this country to carry the infection from one tree and implant it in another.

Observations to date indicate that there are two complete and a partial third generation of the beetles annually and that from about the middle of May until after the middle of September, there is an almost continuous supply of adult beetles. The retarded individuals of one generation overlap the more advanced individuals of the subsequent generation.

The last survey shows that beetle infestation (not Dutch elm disease) in Massachusetts extends as far north as Haverhill near the New Hampshire line, south to Halifax and west to Wayland. In the vicinity of New York the beetle was found in Connecticut as far east and north as Meriden and New Milford, north along the Hudson River to Clermont and as far

west as Bloomingburg. On Long Island the infestation extends as far east as Bay Shore to the south and Rosslyn to the north. The beetle is found over New Jersey except in the southern part and in Pennsylvania from Philadelphia north to Bangor and west to the Susquehanna River. Maine and New Hampshire were not surveyed. It should be remembered that the area covered by this beetle has no immediate relation to the area now covered by the Dutch elm disease.

Use of the Craighead Diameter Tape for Trees Under 1.6 Inches in Diameter

In measuring diameters of trees under 1.6 inches in diameter on a cleaning plot a diameter tape similar to that described by Craighead[1] in the December, 1933, Journal of Forestry was used, since the ordinary tapes could not be bent around the smaller trees. The tape consisted of a strip of thin but not transparent white paper $\frac{1}{8}$ x 7 inches, with a strip of cellophane folded around it. The tape was made as narrow as it could be and still leave the figures clearly legible since for small diameters a wider tape would introduce considerable error.

On the paper, graduations were marked and numbered from an ordinary diameter tape to tenths of inches and each of the spaces was divided in half to facilitate estimating to the nearest hundredth inch. The zero point was placed about $1\frac{1}{2}$ inches from the end of the paper and the last inch of this blank space was pasted to the cellophane to keep the paper from slipping out. The cellophane was then folded around the paper making one thickness of cellophane on one side and two on the other. The edge of the outside fold of cellophane was pasted down where necessary, care being taken that the paper remained free. (More thicknesses of cellophane would eliminate the necessity of pasting, but would make it difficult to wrap the tape around trees the diameter of a pencil.) It was found easier to make the creases in the cellophane before cutting it into strips as it was difficult to make straight folds in a narrow strip.

In the field several extra "Craighead diameter tapes" were carried along in an envelope since they were so small and light that they were easily mislaid and the cellophane available tore or wore out after a day's use. However, any number of the paper strips could easily be made by ruling the graduations all at once and then cutting the strips.

Margaret S. Abell,
Appalachian Forest Exp. Sta.

The New Forest Policy in Germany

In the September 19, 1934, issue of the Report of the German Institute of Business Research (37:7, Page 162-5) there appeared a short and non-technical account of the forest policy of the new regimé in Germany. The attitude of the government is indicated by the establishment in 1933 of a special department for forest and timber policy in the Ministry for Food Supplies (*Reichsernährungsministerium*), the purpose being to secure the position of the forests as an important part of the national wealth and as the producer of one of the most important raw materials. The passage of an act forbidding the clear cutting of coniferous stands under 50 years of age and the reduction of growing stock to less than one-half the normal quantity is cited as the first step in the new forest policy.

A new forest regulation is being worked out, and is being applied to the administration of the Prussian state forests beginning October 1. This regulation looks toward abandonment of the method of clear

[1]Craighead, F. C. A Simple Diameter Tape. Jour. Forestry, 31:977-8.

cutting with planting and substitution of a selective system with natural reproduction. Instead of pure stands, various species are to be used in mixture where practicable. Annual wood requirements will be met mainly by thinning, and in the future each area will be thinned every three years. It is expected that the new method of culture will produce more large logs of high quality and thus will better meet post-war requirements for timber.

The article includes tables showing the relative importance in Germany of the Prussian state forests and their calculated yield under the old and new methods. It also presents graphs showing the increase in value of pine timber with age.

R. C. HALL,
Forest Taxation Inquiry.

MORE ABOUT CALCIUM CHLORIDE AS A FOREST FIRE RETARDANT

In the spring of 1932 a number of chemicals were tested at the Michigan Forest Fire Experiment Station[1] to determine their usefulness in forest fire control. Results secured with calcium chloride led to further tests with this chemical in 1933. The conclusions reached are briefly, that it is an effective fire retardant and that under certain conditions it can be used to advantage in forest fire control.

In all, some forty odd tests were made "to determine":

(1) the effectiveness of calcium chloride as a fire retardant,

(2) the amount of chemical required,

(3) the length of time it remains effective, and

(4) the best method of application.

The tests in question were made on the open jack pine plains during the height of the spring fire season. The fuels involved were grass, sweet-fern, and blueberry, with occasional patches of bearberry and other plains vegetation. This type of cover is highly inflammable when dry, particularly in the spring, before growth starts.

The plan followed was to establish treated strips in advance of burning and either to allow the fire to burn up to them or to back fire from them. In some cases adjoining strips were treated simultaneously with water as a check. In others, different amounts of chemical were used, while in still others the interval between treatment and burning or the method of application was varied.

While calcium chloride is not reputed to have any specific virtue as a fire extinguisher beyond its ability to absorb and retain moisture, it was found that excelsior dipped in a solution of calcium chloride and thoroughly dried (48 hours at 210 degrees and 24 at 250 degrees Fahrenheit) could be charred but would not burn, showing that it tends to render fuels treated with it fire resistant even when moisture is not a factor. Under ordinary conditions, however, its affinity for moisture is such that fuels treated with it remain damp as well, which materially increases their fire resistance.

In the present tests ordinary commercial 77 to 80 per cent calcium chloride ("Dowflake") was used. This comes in 100 pound moisture-proof bags, and in small lots costs in the neighborhood of $1.50 per 100. It is a dry, white, flaky substance, readily soluble in water, and highly deliquescent. It is used extensively on roads as a dust layer and weed eradicator. The recommended application for this purpose is two pounds per square yard. Applied dry, it usually absorbs sufficient moisture to dissolve completely in twenty-four hours or less, and

[1]Maintained by the Michigan Department of Conservation at Roscommon, Mich., in coöperation with the Lake States Forest Experiment Station.

under favorable conditions is said to remain effective for an entire season.

Applied dry to grass and sweet fern cover, calcium chloride is wholly ineffective as a fire retardant since it falls to the ground before dissolving, and hence does not affect the combustability of the fuels which carry fire. Applied in water solution, however, it proved to be very effective. In fact, in every case barring rain where calcium chloride in water solution was applied at the rate of one-fourth pound or more per square yard, it effectively stopped surface fires in grass and sweet fern except where the fire blew across the line or where it burned across in rotten wood or unusually heavy litter which the chemical solution had failed to penetrate. Water, on the other hand, applied simultaneously in the same quantity and in the same way to adjoining strips, proved wholly ineffective after 15 minutes, and only partially effective when applied immediately before burning.

While applications of less than one-quarter of a pound of calcium chloride per square yard caused fires to slow down in crossing lines so treated, they were not effective in stopping fires except toward the wind. On the other hand, more than half a pound per square yard was apparently unnecessary except where the cover was unusually heavy.

Barring rain, calcium chloride treatment apparently remains effective indefinitely. Even a light rain, however, is sufficient to render it ineffective where such fuels as grass and sweet fern are involved, owing to its extreme solubility and the readiness with which it leaches out of such material. In view of this, its usefulness, in regions of frequent rainfall, is limited to that of a temporary expedient.

Best results were secured when calcium chloride was applied in water solution with an ordinary 12 quart garden watering can. The advantage of a watering can being that it delivers a constant, uniform spray of sufficient volume to effectively treat a continuous strip while proceeding at a slow walk, (about eight feet per minute). A back-pack pump has greater capacity, is easier to carry, covers a wider swath, and makes more economical use of water or chemical solution. Its rate of discharge, however, (but one-third to one-sixth that of a watering can, depending on the nozzle used) is inadequate while the intermittent, fluctuating stream delivered by most pumps, combined with the effort required to operate the pump, makes uniform application uncertain. The essentials of satisfactory application are: (1) adequate rate of discharge; (2) constant flow, and (3) uniform distribution. A tank sprinkler or power sprayer mounted on a truck would best meet these requirements, or, where trucks can not be used, a portable pressure sprayer or a knapsack tank fitted with a sprinkler attachment.

In the tests made, three gallons of solution containing 8.4 pounds of calcium chloride, or 2.8 pounds per gallon, was found to be generally satisfactory when applied to 100 feet of eighteen-inch line. Strength of solution, rate and method of application, and amount of chemical per unit area, however, are all more or less inter-dependent, and to a certain extent compensating. *To be effective, however, it is necessary that the volume of solution used be sufficient to insure the satisfactory distribution of an adequate amount of chemical per unit area.* The time element is also a vital consideration from a practical standpoint. Just what the proper balance between these factors is for various conditions and methods of application remains to be determined.

There is no immediate likelihood that chemicals will replace established fire fighting methods and equipment in the control of forest fires. As in urban fire

fighting, however, they will doubtless be found useful as a means of strengthening initial attack and helping out at critical points where the need of effective action is particularly urgent.

Calcium chloride has possibilities in this direction, being much more effective than water in indirect attack on surface fires. When a fire is too hot to be attacked directly, for example, and plows or fire-breaks are not available, calcium chloride properly applied can be used effectively to check its spread and make a direct attack possible, or to establish temporary lines from which to back fire. In the same way it can be used to make the initial attack on small fires more effective and so prevent their getting out of hand. Its use in slash disposal to prevent fires spreading and to keep fire out of certain areas or piles, is also a possibility. It must be remembered, however, that calcium chloride is a fire retardant, not a fire extinguisher, and that it should be used accordingly. The chief drawback to its more general use at the present time is the lack of suitable equipment for its proper application. With a knowledge of its possibilities and limitations, however, the development of such equipment should not be difficult.

J. A. Mitchell,
Lake States Forest Exp. Sta.

Shaded Fire Breaks

During July and August, 1934, northern Idaho experienced another critical fire season. Fires ran, blew-up, and exploded as in 1931, 1929, 1926, 1919 and 1910. These blow-ups often whirled with momentum sufficient to carry the center of heat across barriers of all kinds, from rivers to bare mountain tops. Spot fires originated at distances as much as four or five miles ahead of these fire-generated tornadoes. No natural or man-made barrier was sufficient to stop such methods of spread.

But when the process of combustion ceased in the sky and in the forest canopy, as it did toward midnight nearly every day, the fire came down to ground and could be fought. Then experienced firefighters were heard to remark: "If we can run it into green timber we can hold it."

Out in open timber and in the old burns, single, double or triple, where the ground was covered with all kinds of fuels from bristling snags and criss-crossed windfalls to brush, weeds, and grass, the blazing sun and the unimpeded wind had dried everything, green vegetation included, to a dryness permitting maximum inflammability, and maximum rate of spread of fire. Under such conditions these experienced firefighters often could not hold it. Even their own purposely set backfires became uncontrollable at times when the wind shifted. But under dense, green timber they were able to hold it.

Out in the open the air temperature was 98°, the relative humidity 16 per cent, the wind 5 m.p.h., duff moisture 5.0 per cent, and wood moisture 4.5 per cent. Under a complete green canopy only 300 yards away, the temperature was 93°, humidity 23 per cent, wind 1 m.p.h., duff moisture 10.5 per cent, and wood moisture 8.5 per cent, at the same hour on August 28, a typical day in 1934.

Under the dense, green canopy there was no copious weed or grass growth produced annually, waiting to be ignited like a spray of gasoline. Considerable dead wood, consisting of branches, broken tops, and a few windfalls lay on the ground, but in spite of these the firefighters were able to hold it. The dense, green canopy overhead improved the chances for fire control by keeping all these fuels cooler, more moist, and better protected from the gusts of wind which so often whip a fire out of control.

Time after time, on fire after fire this

year, dense green timber was recognized and used as an area or line in which the chances of control were improved. Functioning as fire-lanes are supposed to, these areas shaded by green timber slowed the rate of spread of fire and were found to offer safer conditions from which to backfire. They contained less of the explosive "flash fuels" so abundant on open fire lanes. If the windfalls and dead branchwood had been cleared on lanes strategically located throughout the green timber, conditions would have been still safer, trench construction could have been pushed at far greater speed, and the fire-fighters would have been able to hold it with even greater ease.

The conclusion is decidedly evident: if the function of fire lanes is to aid in the control of fires, debris disposal on strategically located lanes *under the shade of green forest canopy* is a practicable possibility, which should be given a thorough trial. Such lanes might be found cheaper to construct, less expensive to maintain, and equally or more efficient than the customary cleaned and exposed lanes that are perhaps the best in non-forested brush.

H. T. Gisborne,
Northern Rocky Mountain Forest and Range Sta.

Erratum

In the December, 1934, issue of the Journal, the following correction should be noted: Table 1 (given here) should have accompanied the note "The Effect of Weeding on the Survival and Growth of White and Red Pine," page 1021.

Table 1

AVERAGES OF DATA ON SURVIVAL, GROWTH AND INJURIES OF WHITE AND RED PINE ON WEEDING PLOTS

Plot No.	Species of pine	Treatment	Description of hardwood canopy on check plots	No. of trees measured	Survival per cent	Average d.b.h. of trees breast high and over, 1931	Average height at time of weeding	Average height 1931	Per cent of trees weeviled in period 1929-1931	Per cent of trees showing terminal bud failure in 1929-1931
						Inches	Feet	Feet		
2	White	Weeded 1922		47	97.9	2.4	2.8	12.3	70.2	13.0
6	White	Unweeded	Continuous	115	98.3	.9	2.5	8.1	3.4	27.8
21	White	Weeded 1924		160	98.2	2.3	6.0	13.4	32.1	7.4
23	White	Unweeded	Continuous	159	88.3	.8	4.7	7.7	0	15.7
22	White	Weeded 1924		65	98.5	2.9	6.1	13.6	47.6	3.1
25	White	Unweeded	Continuous	50	98.0	1.2	5.3	9.6	2.0	22.0
9	White	Weeded 1923		114	90.5	1.6	2.9	8.6	71.9	2.6
9A	White	Unweeded	Continuous	84	97.6	.7	2.0	6.3	8.3	19.0
4C, 26C	White	Weeded 1924		90	....[1]	1.7	3.7	10.2	51.0	1.0
4, 26	White	Unweeded	Partial	88	98.8	1.3	3.9	10.0	31.8	16.0
19	Red	Weeded 1924		177	98.8	2.3	5.1	13.3	0	15.8
20	Red	Unweeded	Continuous	139	96.5	1.3	4.8	9.0	0	65.0
41	Red	Weeded 1918		25	——	2.6	.7	13.2	0	16.0
42	Red	Unweeded	Continuous	21	——	.4	.5	4.5	0	19.0
4C, 26C	Red	Weeded 1924		70	....	2.2	3.7	11.4	0	5.8
4, 26	Red	Unweeded	Partial	68	93.1	1.4	3.2	9.4	1.5	8.8

[1]Plots 4C, 26C, 41 and 42 are temporary plots for which there are no available records on which to base the determination of survival.

REVIEWS

Effect of Frequent Fires on Chemical Composition of Forest Soils in the Longleaf Pine Region. By Frank Hayward and R. M. Barnette, *Fla. Agr. Exp. Bull., 265. March, 1934. 39 pp.*

The effect of forest fires on soil in the longleaf pine region has been the subject of some experimentation and considerable conjecture during the last fifteen years. The effect of fire on forest soil is of interest to timber growers in the South because of the possible bearing that soil changes may have on the growth of trees. The longleaf pine region has been subjected to frequent fires for many years. Scientific information on some of the effects of frequent burning is particularly timely in view of the present trend of thought toward the possible use of fire in the silvicultural management of the species.

The bulletin reports the effect of frequent fires on some of the chemical properties of the important soils of the Atlantic and Gulf Coastal Plains, upon which longleaf pine predominates. The chemical properties investigated were: total nitrogen, loss on ignition, replaceable calcium, and hydrogen-ion concentration (pH). A preliminary study was made to detect any general trends of change in these constituents that could be associated with fire treatment. Eighteen locations from South Carolina through Florida to Louisiana were sampled. Each location consisted of an area unburned for at least ten years, and an area immediately adjacent that had been burned frequently during that period. Plots of one-eighth acre or smaller were located in burned and unburned areas and four pits dug at random in each. Samples were collected from three depths in each pit: 0 to 3 inches, 4 to 8 inches, and 18 to 24 inches. The analyses of 216 samples from burned areas and a like number from unburned areas indicated heavy odds in favor of the burned soils for greater replaceable calcium and higher pH, 11 against 2, and 12 against 1 respectively; these trends were much weaker in the second and third depths. Nitrogen and loss on ignition revealed no indicative trends.

On the basis of the preliminary work eight areas were sampled with sufficient detail to determine variation in the measured properties from place to place. Twelve individual samples were collected from each plot in one area, and thirty individual samples from each plot in another area; on the basis of analyses of these samples an estimate was made of the minimum number of samples necessary to give reliable mean values. Results of the intensive study was based on thirty samples from each burned and unburned plot of two areas, one hundred samples from another area, and one hundred sixty samples from each of the remaining five areas. The intensive sampling was confined to the surface soil because no large and consistent difference could be found in the soils at depths greater than four inches in the preliminary study.

Seven of the eight soils from burned areas had more nitrogen than the soils from corresponding unburned areas; but in only two cases were the differences

greater than two standard errors. Loss on ignition was greater in burned soils in five of the eight areas; one area showed significantly greater loss on the unburned plot while three areas showed significantly greater loss on the burned plots. Replaceable calcium was greater on the burned plots in seven of the eight areas, and the difference was statistically significant in five cases. Hydrogen-ion concentration was consistently lower in the burned areas in all eight cases.

No correlation was found between effect of fire and soil type, although the soils varied greatly in physical and chemical composition, from deep sands of low fertility to silt loams of relatively high fertility. The eight areas sampled in detail were grouped and the results of each test averaged for the burned and unburned portions. The mean percentage of total nitrogen in the burned areas was 0.0521 which was 0.0028 per cent greater than in the unburned areas; odds were 96 in 100 that the difference was due to fire. Mean loss on ignition of the soils from burned areas was 3.304 per cent, which was 0.180 per cent greater than for the unburned areas; odds were 86 in 100 that the difference was due to fire. The mean replaceable calcium content for the soils from burned areas was 0.0371 per cent, which was 0.0085 per cent greater than for the soils from unburned areas; odds were 99 in 100 that the difference was due to fire. The reaction of the soils from burned areas was 5.7 pH units, which was approximately 0.2 pH units higher than for the unburned areas; odds were 99 in 100 that the difference was due to fire history.

One of the outstanding features of the bulletin is the very commendable sampling technic of the investigators. Because of the great variation in amounts of some chemical constitutents of the soil from place to place, inadequate sampling often results in premature and incorrect conclusions. However, in this work the sampling appears to be adequate and the mathematical significance of the results was determined. The data indicate that fire results in an increase in soil organic matter content as determined by loss on ignition; however, it must be remembered, as the authors themselves point out, that a notable amount of the loss on ignition of the burned soils can be attributed to the accumulation of charcoal which is not readily broken down by soil organisms and persists for long periods. Frequently burned longleaf pine land supports an abundant ground cover of wire-grass and a wide variety of herbaceous plants, including numerous legumes. Areas unburned for long periods have a very scant ground cover. The difference in organic matter content and total nitrogen can be explained in part by the difference in ground cover on the two types of areas.

The greater amounts of replaceable calcium found in soils of burned areas is due to the immediate conversion of the calcium in the organic matter to the replaceable form and its greater incorporation into the mineral soil as a result of burning. It seems doubtful that the slight increase in available calcium is reflected in tree growth. Likewise, the slight decrease in soil acidity which the authors found probably has little influence on tree growth, or on the activity of soil organisms. The increased amounts of organic material in the soil of burned areas may have some slight significance, particularly in the light soils of the Southeast.

From the standpoint of the chemical properties and constituents studied, frequent fires in the longleaf pine region do not appear to have a deleterious effect on the soils. Conversely, in some instances slight soil betterment seems to result. However, the investigation of the effect of fire on the soil is not complete without measuring physical changes because of the

close relationship between certain physical properties and the availability of water and plant nutrients.

T. S. Coile.

Logarithmic Expression of Timber-Tree Volume. By Francis X. Schumacher and Francisco Dos Santos Hall, *Jour. of Agric. Research, Vol. 47, No. 9, November 1, 1933. pp. 719-734.*

Foresters should welcome this paper, especially those already interested in forest mensuration and the application of statistical methods to volume table procedure.

It has long been assumed that the relationship of volume to diameter and height differs among timber species and among localities for the same species. The usual method of constructing volume tables has involved the use of free-hand curves. Because free-hand curves are subjective, this method has not made it possible to test accurately the significance of the difference between volume tables for two species or the difference between two stands of the same species in different localities.

In this paper the authors present a mathematical and therefore objective method of determining tree volume and of making volume-table comparisons among species and localities. Equations are developed and rationalized for determining cubic-foot volume for the entire stem and both cubic- and board-foot volume to a fixed top diameter. The equations are changed from the product type, which are curvilinear, to the additive type, which are linear, by the use of logarithms. An equation of this type was fitted to data of nine different timber species. In each case the relationship of volume inside bark to d.b.h. inside bark and to height proved to be linear. This led the authors to believe that the equation type developed is generally applicable.

With a mathematical expression of the relationship of volume to d.b.h. and height it is possible to compute the error of estimating volume with any combination of diameter and height. It is therefore possible to compute the significance of the difference between volume equations of the same or different species throughout their range of diameter and height. Since this type of volume equation permits the use of the standard error of the function as a basis for statistically testing the significance of the difference among volume tables, its value is evident. The significance of the difference is expressed in terms of probability. A difference of twice its standard error is considered the lower limit of significance. This is roughly equivalent to the corresponding limit, probability = .05; in other words, in 19 out of 20 other samples of like numbers of trees the difference should be less than that which is termed significant in these tests.

An error was discovered by the reviewer in applying equation (4)

$$V = D^{b_1} H^{b_2} C$$

in constructing cubic-foot volume tables of the entire stem for ponderosa pine. In this equation V, D, H, and C represent, respectively, volume in cubic feet, diameter at breast height, total height, and the constant term. The equation as stated assumes zero volume for trees with zero d.b.h. but with a height of 4.499 feet, whereas it should take the actual cubic-foot content of a tree of that height as the volume. But restrictions placed on the dependent variable affect the regression equation; accordingly a correction should be made. With the coordinate of volume placed at the actual volume of a tree just 4.499 feet high and the coordinates of d.b.h. and height placed at zero and 4.5 feet, respectively, the equation can be written

$$V - v = D^{b_1} (H - 4.5)^{b_2} C$$

when v = the volume of the tree 4.499 feet in height and 4.5 = breast height. With the original equation (4) the volume, d.b.h., and height relationships for a sample of 142 ponderosa pines showed curvilinearity. The corrected equation gave linear relationships throughout. This correction for volume becomes negligible when dealing with trees over 3 inches d.b.h. and over 20 feet in height, but the correction of height should be made throughout the entire range of heights.

EZRA M. HORNIBROOK,
S. W. Forest and Range Exp. Sta.

Multiple Correlation Analysis as Applied to Farm-Management Research. By Stanley W. Warren, *Cornell Univ., Agric. Exp. Sta. Memoir No. 141, May, 1932.*

In this bulletin Professor Warren deals particularly with the factors affecting the choice of independent variables and with the factors affecting change in the form of the regression equation. He brings out the result of ignoring joint relationship by giving an example in which the true net regression of a dependent variable on the independent variable was found to have a negative slope, but in which it was found to have a positive slope when joint correlation was ignored. After discussing joint and causal correlation the author criticizes several articles and bulletins in which multiple correlation has been used. His criticism in each case is based primarily on a logical analysis of the problem, showing that the type of regression equation used does not express the existing relations.

After reading his bulletin one cannot help realizing that before attempting to solve any problem through multiple correlation it is necessary to subject the problem to logical analysis.

ROY CHAPMAN,
Southern Forest Exp. Sta.

Journal of the British Wood Preserving Association. Edited by A. H. Lloyd M. C. and R. C. B. Gardner. *Volume IV., 1934.*

The Journal is the official publication of the British Wood Preserving Association and includes 5 major lectures presented at meetings of the Association, discussions, shorter articles and notes. These lectures are by no means confined to the routine problems which confront the average wood preserver, and as a whole are of considerable interest to the forester.

"Wood Preservation in the Service of the Post Office," by R. G. Bennett, describes the use of wood by this important government service which has a monopoly on the entire communication service of the British Isles. Poles and cross-arms are the chief items given preservative treatment by the Post Office which annually consumes over 1¾ million cubic feet of preserved forest products. The first preservative treatment of poles on record in the Empire was in 1844 and since that time considerable progress has been made. The standard pole now used by the Post Office is of Scots pine the majority of which are imported from the Scandinavian countries. Larch has also been used considerably but its tendency to shake and its inability to absorb creosote, despite incising, has led to its abandonment. Ample seasoning time is always allowed, with the result that steam conditioning which is standard practice in the United States is never resorted to. The treating processes are not unlike those used in this country, the marked exception being that a final retention of only 4 pounds of creosote per cubic foot of wood is the objective, whereas American wood preservers insist upon a minimum

of 8 pounds per cubic foot. Another remarkable point is that the Post Office has failed to see the wisdom of boring and framing poles before treatment which is considered an essential practice in this country. From the silvicultural standpoint it is interesting to note that many of the planted stands of Scots pine are being managed for ultimate conversion into poles by practicing thinnings and branch prunings so as to produce the desired type of tree.

"Development of Diseases in Living Trees," by W. R. Day, is of more interest to the forester and the pathologist than to the average commercial wood preserver as it deals with the origin of decay in living trees. The lecturer, a distinguished pathologist, emphasizes the fact that faulty silviculture is responsible for much of the decay in trees. Correct stocking and the proper choice of species for the site in question is important in preventing serious losses due to decay. In addition to keeping the crown of the tree in a healthy condition, the author also points out that the root of the tree must remain healthy to prevent the establishment of heart-rotting fungi.

"The Use of Treated Timber in Railway Stock Construction," by W. H. Brown. This lecturer, who is Carriage and Wagon Works Manager, of the L. & N. E. Railway, gives a description of the construction of railway cars in Great Britain. It deals chiefly with the use of glues, fasteners, paints and varnishes. Long life is obtained from the wood by providing ventilated walls and protecting all points of contact. Softwoods from the Scandinavian countries, teak from Burma, mahogany, from Cuba, Honduras and Africa, and oak from English-grown timber are the chief species used in this work. Of particular interest is the length of seasoning, and often as much as 4 years elapse before the wood is finally used.

"Coal-Tar Creosote Oil as a Wood Preservative," by N. A. Richardson, Forest Products Research Laboratory, Princes Risborough. This lecture deals with the carbonization of coal and the later distillation of the coal tars into creosote. Considerable attention is devoted to toxicity tests of the various creosotes and their constituents with the inevitable result that only extended service tests will tell the whole story. There is an abundance of real meat in this lecture for those interested in the study of creosote oils.

"Timber Buildings," by I. J. O'Hea. The use of buildings of frame construction such as are common in the United States are in considerable disrepute in the British Isles and legislation against this type of construction is common. Mr. O'Hea described wooden buildings in many countries and enumerated many advantages of this type of construction.

In hardly any field originally held by timber has so much headway been made by substitutes as piling. Compared with its use in the United States, wood piling is used only occasionally in Great Britain. A short article on "Creosoted Douglas Fir Round Piling," by Geo. G. Herrmann, Vice-President of the Vancouver Creosoting Co., which describes the specifications, treatment and use of this Pacific Coast wood is, therefore, timely.

H. F. Round,
Pennsylvania R. R.

Wild Flowers. By Homer D. House. *The Macmillan Co., New York. Pp. 362. Plates 264. Fig. 35 + 95. 1934. $7.50.*

Here's a book that will delight both the amateur and the professional botanist. It makes identification of wild flowers easy for the amateur, and to the professional botanist it offers most perfect illustrations in color. The forester in particular should welcome the opportunity present-

ed by this book to become acquainted with the wild flowers he wishes he'd know better while on field trips.

There are 364 illustrations of flowers on 264 plates made from color-photographs. They are therefore faithful not only as to configuration but also as to color. In addition there are 35 half-tones of other flowers. The color plates are of good size, measuring 7″ x 9″. The pages are cut to 9″x 11½″. Each species illustrated and many additional ones are fully described in the text as to floristic characters, habitat, range, etc. A 23-page chapter, illustrated with 95 line drawings of flower types, leaf types, etc., gives the untrained reader a knowledge of plant structure adequate for understanding the description of individual plants.

While most of the species pictured are eastern, some are of transcontinental distribution, but many of those not so widely dispersed have comparable and very similar western representatives. The book is therefore useful East and West.

The plates were made originally for a similarly styled publication of the New York State Museum and those who have seen the author's previous work will recognize the pictures at once. Those who tried to obtain a copy of the Museum's publication only to find it unavailable, as has the reviewer, will be glad to know that this new and privately printed edition is now obtainable at a price which would have been impossible had the plates not been available from the earlier book.

The author is well known to many foresters. He has been a member of the Society of American Foresters for many years, and was instructor in botany and dendrology in the former Biltmore Forest School.

EMANUEL FRITZ,
University of California.

ANNUAL MEETING ✦ ✦ ✦

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